UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
ASHEVILLE DIVISION

STATE OF NORTH CAROLINA ex rel. Roy Cooper, Attorney General,	)	
Plaintiff,	)	No. 1:06-CV-20
vs.	)	**VOLUME 2A**
TENNESSEE VALLEY AUTHORITY,	)	[Page 268-397]
Defendant.	)	

TRANSCRIPT OF TRIAL PROCEEDINGS
BEFORE THE HONORABLE LACY H. THORNBURG
UNITED STATES DISTRICT COURT JUDGE
JULY 15, 2008

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I N D E X

PLAINTIFF'S EXHIBITS

DEFENDANT'S EXHIBITS:

P R O C E E D I N G S

THE COURT: All right. Are the parties ready to proceed?

MS. GOODSTEIN: Yes, Your Honor. Good morning. I'm Michael Goodstein on behalf of the State of North Carolina. I switched chairs with Mr. Gulick, I hope that's okay, for the purposes of today.

THE COURT: That's fine.

MR. GOODSTEIN: I think that will move the flow of evidence along more quickly, hopefully.

I have a couple of preliminary matters, Your Honor, if you're ready for those.

THE COURT: Yes, sir.

MS. GOODSTEIN: We have a confidentiality issue that we wanted to advise the Court of that's going to come up with our next witness, Jim Staudt, who is a pollution control engineer, an expert witness for the State.

And TVA has claimed confidentiality with regard to their long-range plan exhibit, and this was produced in the middle of discovery under an agreed protective order that Your Honor entered in September of 2006. So there are procedures in place that we've been using during discovery to try and protect -- do the best we can to protect the confidentiality of TVA's long-range plan.

We have some exhibits that are going to come up

with Dr. Staudt's testimony that the claim of confidentiality is still applicable to. We also have a supplemental report that Dr. Staudt prepared that is also subject to the confidentiality claim of TVA.

The report, we want to mark for identification this morning. There is a motion in limine pending on expert reports, and we want to prepare to have them marked for identification by each of the witnesses. If Your Honor decides to receive expert reports into evidence, then we'll be prepared to do that. So...

THE COURT: All right. Mark --

MR. GOODSTEIN: Those are a couple of preliminary issues.

On the confidentiality issue -- I'm sorry, Your Honor.

THE COURT: I was going to say, mark it for a particular exhibit. Is that where the problem comes, as to what the exhibit contains?

MR. LANCASTER: Yes, sir. There are actually two categories of situations here. The exhibit, the supplemental expert report that Mr. Goodstein made reference to I do not believe he intends to actually move into evidence at this point, and so I don't think he intends to publicly display it. He simply is going to have his witness authenticate it. If it does not become part of the public record as a result

of that process, that won't be a problem.

Mr. Goodstein is correct, there are some confidentiality issues in this case. The Court entered a protective order, and the parties have done, I think, a pretty good job of working with each other to provide confidential information. Among all the confidential information that was provided during the course of the case, we winnowed it down to two exhibits on each side. We have two of our exhibits as to which plaintiff claims confidentiality. They have two exhibits with respect to which TVA claims confidentiality.

The protective order that the Court entered indicates that the receiving party, before filing or disclosing confidential information in court, the receiving party here, the plaintiff, of course, is free to use the information to try to prove its case, but before filing it in court or publicly disclosing it, shall take measures to prevent the information from inadvertently becoming part of a public record, including filing any documents contained in protected information under seal.

So we would request that the two exhibits that plaintiff has identified for use and will presumably move into evidence, that they be placed under seal and not disclosed openly in the courtroom.

THE COURT: All right. I have no problem with

that.

MR. LANCASTER: Thank you, Your Honor.

THE COURT: On both sides.

MR. LANCASTER: Thank you, Your Honor.

THE COURT: So when the matter comes up, just note it so that I can take whatever precautionary measures we need to take to protect it from public disclosure.

MR. LANCASTER: Thank you, Your Honor.

MR. GOODSTEIN: With regard to the live testimony that's going to discuss those exhibits, I'm going to put TVA's counsel on notice when that's coming up and they can request whatever special procedures they want regarding the courtroom, if that's okay with Your Honor.

THE COURT: All right, sir.

MR. LANCASTER: If I could add to that, Your Honor.

Mr. Goodstein and I just had a brief discussion before the Court entered the courtroom and it was my understanding we had reached an agreement that general statements about TVA's long-range plan -- there is a plan in place to add additional scrubbers, more than three or four or five years from now. We're talking out in 2017, 2018. Those kinds of references are certainly fine to be made. References to consideration of plant closures generally are certainly fine to be made and open to the public.

But any indication of specific planned activities

that are still in the planning stages several years out and have not been disclosed or any specific discussion of the closure of a plant that has not been made public, which is very sensitive, similar to closing an Army base, none of those would be made in open court, and it was my understanding the oral testimony would be able to be given by way of those general types of references.

MR. GOODSTEIN: And we're going to do our best, Your Honor. This is very important testimony, obviously, so we want the Court to be fully apprised about that, and we're going to do our best to cabin it in a way that doesn't involve interruptions, but if I do ask a question that counsel is concerned is going to elicit confidential information about some of their confidential business information, then we're going to have to take it on a question-by-question basis.

THE COURT: Well, have you both talked with your proposed witnesses and told them what is involved --

MR. GOODSTEIN: Yes, sir.

THE COURT: -- and where they're to tread lightly or not at all?

MS. GOODSTEIN: Yes, sir. We've dealt with this issue throughout discovery. All our experts have signed the confidentiality form and they're familiar with your order; and Dr. Staudt has been fully apprised of what we've been

able to work out as far as the procedure so far, so I think it should work fine.

THE COURT: And if we are moving into a problem area, when you make an objection, rather than your general objection, just say, "objection, confidential," and that will alert me to take a closer look at it.

MR. LANCASTER: Yes, Your Honor. If I could just briefly close the discussion by noting that we provided Mr. Goodstein with a list of the actual items that we contend are confidential and which ones are not, and our basic position is that general references are fine; naming names is not.

So if Mr. Goodstein is about to have a witness name one of the names that has been designated, that's the area of which we would like those protections to come into place.

THE COURT: All right. Fine.

All right. Call your --

MR. GOODSTEIN: If I may approach, I have a courtesy copy of Dr. Staudt's exhibits I'd like to hand up.

THE COURT: All right.

MR. GOODSTEIN: These are in your large binders, Your Honor, but this way they're right in order of presentation and they're in one binder for you.

THE COURT: Good.

MR. GOODSTEIN: Okay. What I will note is that the supplemental report, the supplemental expert report, which is

at the back of your binder, Your Honor, that is a confidential submission because it refers to and analyzes information that TVA has claimed confidentiality over. So we filed that under seal with the Court previously, and I just want to note for the record the pages are labeled confidential.

THE COURT: All right, sir.

MR. GOODSTEIN: All right. North Carolina calls their next witness, Dr. Jim Staudt.

MR. LANCASTER: Your Honor, I actually have one preliminary matter myself, if I may bring it up.

I just wanted to alert the Court that Mr. Goodstein and I reached an agreement that TVA does not object to the qualifications of this witness as set forth in the plaintiff's statement of witness expertise that was filed the first day of trial.

THE COURT: All right.

MR. GOODSTEIN: We're aware of that, Your Honor. And Dr. Staudt's CV is the first document in the binder I just handed up, and we'll just hit the highlights, but it's important background for you as we get into his conclusions.

THE COURT: All right. Let that be admitted.

(Plaintiff's Exhibit No. 425 received.)

(Witness sworn.)

MR. GOODSTEIN: Your Honor, we offer Plaintiff's

Exhibit 79 and Plaintiff's Exhibit 58 into evidence, and I'm not aware of any objections.

MR. LANCASTER: There is no objection. I only ask that Dr. Staudt actually identify what the photograph is.

THE COURT: All right.

MR. GOODSTEIN: We can do that.

JAMES STAUDT,

being duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. GOODSTEIN:

THE WITNESS: The photograph is a photograph that was taken during a site visit to the Widows Creek power plant. The smokestacks that you're seeing, the one on the left is Widows Creek No. 7; the one on the right is Widows Creek No. 8.

And you can see that the one on the right here has a nice puffy plume. It's basically -- that's just water vapor. And the one on the right is -- that's actually particulate. We'll talk a little bit about that later during my testimony. That is a -- that's basically -- the air pollution control devices were not in operation at that point when we were visiting the plant.

BY MR. GOODSTEIN:

Q. As long as we're here, this was a photograph that was taken on the day you were on your site visit to the Widows

Creek power plant on April 10th, 2007?

A. Yes, that was taken during my site visit at Widows Creek.

Q. That's a fair and accurate depiction of what those smokestacks looked like on that day?

A. That is a fair and accurate depiction of what those smokestacks looked like on that day, yes.

MR. GOODSTEIN: Would offer Plaintiff's 79 into evidence, Your Honor.

THE COURT: Let it be admitted.

(Plaintiff's Exhibit No. 79 received.)

BY MR. GOODSTEIN:

Q. Okay, Dr. Staudt. Good morning.

A. Good morning.

Q. I'd like to turn your attention to Plaintiff's Exhibit 425. It should be the first document in your book.

You have your exhibit binder there?

A. Yes.

Q. It's been admitted. And is that a copy of your CV?

A. Yes, it is.

Q. Can you give us a little summary and background on your educational experience?

A. I graduated from the United States Naval Academy in 1979 with a bachelor's degree in mechanical engineering. I served in the U.S. Navy for five years in the Navy nuclear program

in the engineering department on USS ENTERPRISE. It's a nuclear-powered aircraft carrier.

When I completed my service, I went to Massachusetts Institute of Technology and received a master's and Ph.D. in both mechanical engineering. Master's thesis was in the field of coal combustion research; the Ph.D. in the field of gas turbine design.

Subsequent to that, I worked briefly at a gas turbine design firm, then joined -- for about a year -- and then joined Fuel Tech, where I -- which is a NOx control supplier to the utility industry, and I was programs manager there, where I managed a group of people who developed a Selective Non-Catalytic Reduction process for NOx control, and we installed these systems on power plants and industrial facilities.

Q. What do SNCs, what you just referred to, what pollutant do they control?

A. The oxides of nitrogen, which is one of the pollutants that are of concern in this case.

I also worked as product director of NOx control at the Research-Cottrell Company, and in that capacity I was responsible for all aspects of Research-Cottrell's NOx control business, including the design of the systems, the installation of the systems and starting them up. And I had people, of course, there to support me in all of those

activities.

I then worked at a company, Spectrum Diagnostics, which was owned by a company called Physical Sciences of Andover, and developed instrumentation that was used to monitor gases, some of them very toxic, at refineries and others at power plants.

After that, I -- that was in 1997 -- I left Spectrum Diagnostics and I started my own business as a consultant.

Q. Can you tell us about your consulting activities, please?

A. My consulting activities are focused primarily on air pollution control technology cost and performance analysis. Clients include USEPA -- U.S. Environmental Protection Agency -- they include a number of power companies, and they include states.

I've done a substantial amount of work for the State of Illinois in helping them with multi-pollutant control rules and mercury control rules. I also provide consulting services to some of the companies that build power plants, including companies like Austin and Babcock Power and some of the other companies we may discuss later on during my testimony.

In addition, I hold a designation called Chartered Financial Analyst, which is a three-year intensive program that involves taking three full-day examinations. Most

people with this type of designation work as bonder equity analysts at financial firms. I use that expertise to help me analyze costs and understand how companies make business decisions with respect to air pollution control technology.

Q. Dr. Staudt, could you please give us some examples of the types of projects you've worked on for utilities in the pollution control engineering sector?

A. Yes. I'll direct you to some -- to page 6 of 9 of my exhibit here. I'm currently assisting Constellation Energy, who is subject to the Maryland Healthy Air Act, and they are subject to NOx, mercury and SO2 emission controls.

We have been supporting them primarily in the area of mercury control technology, as well as NOx control technology, and focusing primarily at the plants at Wagner and Crane.

Arizona Public Service Company is shown there. I assisted Arizona Public Service Company with evaluating NOx control technologies at their Four Corners plant.

Allegheny Energy, I assisted them in evaluating costs and how to -- cost effective controls for what's called a PURPA plant. That's basically an independent power company that was established under an act in 1978 or '79 where Allegheny was obligated to buy power from this plant and that gave Allegheny some rights in terms of how that plant might be able to increase its costs. So I was involved in a

program to evaluate what they were doing there.

Another is PG&E Generating. They were examining the acquisition of Ducane Power and Light's generating assets. Ducane is out of Pittsburgh, and they had a number of coal-fired assets that they were examining whether or not they were going to try to purchase, and they wanted to get a sense of what the environmental liability might be in terms of complying with expected future NOx and SO2 control requirements.

Q. You also mentioned that you do consulting for USEPA in the air pollution control and cost area.

Can you give us some examples of the projects you've worked on with USEPA, please?

A. Yes. If you go to the next page, page 7, that project that we recently-- we haven't quite completed but we provided a draft report to USEPA, went back and evaluated the costs associated -- it's an ex post analysis of the costs of the utility industry to comply with Title IV of the 1990 Clear Air Act amendments, the NOx SIP call, and the OTC NOx Budget Rule. So we evaluated the costs associated with NOx and SO2 technologies that were employed on power plants throughout the U.S. to comply with those rules.

And I've done an extensive amount of work with EPA. I've done work in the area of mercury control. In the area of mercury control, I've done a fair amount of work on

helping EPA understand the technologies that are available for coal-fired power plants and mercury control, what they're capable of doing, what they will cost, and how they would be appropriately employed at a facility depending upon its configuration.

Q. You also received some recent recognition from the USEPA for your work for them. Can you describe that?

A. In late May, I received a USEPA Science and Technology Achievement Award for work -- relating to work that I did with some EPA scientists and engineers relating to mercury control educating -- I'm trying to remember the exact wording of the -- I won't be able to remember the exact wording of the citation, but it relates to providing information to the public on the cost and availability of mercury controls for coal-fired power plants.

And it was at a congressional reception in Washington, so -- and it's for EPA. It's unusual for an outsider to get one of these things, so I was very pleased to be recognized in that way. It's usually just EPA people getting them.

Q. You mentioned that you have some training and experience in combustion. Could you please just summarize that for the Court?

A. Combustion. You know, I have a -- in my master's degree at MIT, you know, that was -- that was in the field of coal combustion research, I did -- in the area of coal combustion,

the gentleman named Professor John Deere, in that field, is kind of famous. I don't expect anyone here to recognize the name. But they have a big combustion research facility there and have done work there.

And since that time, whether it's working for Fuel Tech or -- when I was with Fuel Tech, they actually owned a burner company as well, and the field of NOx control is where I've spent a fair amount of time. It's very closely tied to combustion because that's where NOx is formed, in the flame. So I spent a fair amount of time in the field of combustion science.

Q. So approximately, just to summarize for us, how many years of experience do you have in pollution control engineering and costs?

A. I would certainly include every year since I completed MIT in '84. So it would be maybe over 20 years.

MR. GOODSTEIN: At this time, Your Honor, we tender Dr. Staudt as an expert in air pollution control engineering and costs, and I don't believe there is any objection.

MR. LANCASTER: As stated earlier, in the scope of that field, no objection.

THE COURT: Let the record show that the Court so holds.

BY MR. GOODSTEIN:

Q. You are also a member of the Institute of Clear Air

Companies, Dr. Staudt?
A. That is correct. In the Institute of Clean Air Companies, I'm actually an associate member, not a full member. The Institute of Clean Air Companies is an organization of the companies that supply pollution control technology to power plants, to industry.
And as assoc -- full members are typically those companies that actually build the equipment. As an associate member, you know, I get -- I get to interface with many of these people, which is helpful in getting the most up-to-date information on what's happening in terms of their businesses and what's -- and how their businesses are being affected by regulations or changes in regulation.
Q. And the members of the Institute of Clean Air Companies, do they provide scrubber technology and SCR and NOx control technology to utilities?
A. Yes. Just about every supplier -- and it's -- I say "just about" because there may be somebody who isn't, but just about every supplier of scrubbers or NOx control technology is a member.
Q. And the Institute of Clean Air Companies, do they also provide reliable data and information about the availability of controls for nitrogen oxides and sulfur dioxide?
A. Yes, they do. As an association of companies, they want to try to make sure that the information that -- an important

job of theirs is to educate the public, educate EPA on the availability of controls and what they're capable of doing, educating the companies that may be buying the technologies, and also, from the perspective of their own interest within their membership, they want to try to anticipate what's happening in the marketplace, for example, if a regulation is passed, how it may affect them, because they all need -- it's very important for them to try to plan ahead for all their business purposes to determine roughly how much business is going to be out there if they need to add staff, reduce staff. So they try to make those projections as accurate as possible because there are things that they rely on for their own business purposes.

Q. And do you participate in regular activities with the Institute of Clean Air Companies and review their data on a regular basis?

A. Yes, I do.

Q. And what types of information do you obtain?

A. Well, the information involves -- ICAC produces a number of documents. They may produce a document on SCR technology or on scrubber technology. And I participated in some of those what they call white papers that get provided to folks like EPA.

They also produce on an annual basis a market study where they evaluate -- they try to anticipate what's going to

happen in the future because for their planning purposes.

This industry is an industry where it's driven primarily by regulations. And so it's not like selling toothpaste, where there's a steady growth in the number of people so there will be a steady growth in people who need to brush their teeth.

This is where the market needs to be -- it takes a lot of planning because you need to be able to anticipate when you're going to need to hire people, when you're going to need to buy equipment, et cetera. So they try to make projections of what's going to happen in the market.

Q. Do you have a recently scheduled activity that's coming up with the Institute of Clean Air Company?

A. Yes, I do. On Friday, I'm going to be participating in a conference call to discuss what are the implications of the recent vacatur of the Clean Air Interstate Rule because, with it just happening, of course, there's a lot of questions over what that means for some of the projects that are in the pipeline, what are the -- you know, the projects that are under way, because the Clean Air Interstate Rule is a major motivation for many of these projects, these scrubber projects and SCR projects that were in the pipeline, so to speak.

Q. Can you explain to us a little bit more about what the implications of vacating the Clean Air Interstate Rule, which

happened this past Friday, will have on the industry that provides scrubber and SCR technology and why --

MR. LANCASTER: Objection. I apologize. I thought he completed the question.

BY MR. GOODSTEIN:

Q. Can you explain a little more, Dr. Staudt, about the implications of the vacating of the Clean Air Interstate Rule and how that's impacting the members of the Institute of Clean Air Companies of which you are a member?

MR. LANCASTER: And Your Honor, I object. Calls for speculation about how utilities will respond to that vacatur of the rule.

THE COURT: Overruled.

THE WITNESS: Because the Clean Air Interstate Rule was an important motivator in the decision of many utilities to install control technology to reduce their SO2 or NOx emissions in some other way, there is a significant risk that this will have, perhaps, a chilling effect.

We've already seen what's happened with the vacating of the Clean Air Mercury Rule.

As a result of the Clean Air Mercury Rule, which required the use of emissions monitoring methods for mercury, a number of utilities have put their -- put their monitoring system orders on hold until such a time as they -- as things get resolved by -- in a similar manner, it would be -- it

would not be surprising to see a number of utilities with plans to install scrubbers or SCRs to put some of those projects on hold until things become resolved.

BY MR. GOODSTEIN:

Q. And the Clean Air Mercury Rule, can you explain to us, in summary, what that involved?

A. Excuse me?

Q. I'm sorry. Can you explain to us in summary what the Clean Air Mercury Rule involved?

A. Well, the Clean Air Mercury Rule involved a cap-and-trade program for trading mercury allowances, and it was vacated by the court last fall, I believe, because -- it was originally because of the procedure -- it was issued -- you can't have a cap-and-trade program under a Section 112, and there was originally a decision in 2000 that it should be listed -- that power plants should be listed under Section 112. So it got vacated as a result of that court decision.

Q. I'd really like for you to explain to us, Dr. Staudt, based on your experience in the industry, providing these pollution control technologies to, like, the utilities, like TVA, and how the CAMR rule and the CAIR rule were significant drivers to the activity and how you see the vacating of those two federal rules by the DC circuit affecting the activity of utilities installing these control devices.

A. Yes. Both rules -- the Clean Air Mercury Rule primarily

relied on the Clean Air Interstate Rule to provide the reductions in mercury through co-benefits -- expected co-benefits of the control technologies that were going to be expected to be installed for the Clean Air Interstate Rule.

In light of the fact that the Clean Air Interstate Rule has been vacated and the future is highly uncertain, of course, those reductions in mercury that were expected to occur under the Clean Air Mercury Rule are not going to -- are not going to happen unless something else happens to take its place.

There are a number of states that -- not just North Carolina -- that have seen some of the -- seen some of the problems that they see with the federal programs, the shortcomings of the federal programs and their deal, and have stepped in to set their own requirements for their own power plants. Not just in North Carolina, as I stated earlier.

The State of Illinois is a client of mine. They have multi-pollutant requirements on their system operators. The State of Georgia has technology based requirements that caused Southern Company to install a lot of the scrubbers.

In fact, Southern Company -- a good friend of mine from MIT works at Southern Company, and we were commenting that -- I met him in April, and he said that Southern Company was going to go from being the least scrubbed utility to the most scrubbed utility in a few years.

And Constellation, which is another client, is subject to Maryland's Healthy Air Law.

So a number of states have stepped in because -- and acted on their own because they identified some shortcomings in the federal programs.

Q. So do you see the vacating of these significant federal drivers as affecting activities?

A. Yes. In those states where they didn't have their own additional requirements, whether it's North Carolina, Illinois or Maryland or other states, they were relying on the federal program to get them to where they hoped to be in the future.

Now, with the federal program gone, one thing that's for certain that you can say -- there is no certainty, but the one thing that is for certain is that this is not going to cause people to accelerate scrubber projects, vacating the Clean Air Interstate Rule. It is far more likely to cause companies to delay, postpone, perhaps cancel programs.

Q. And are you -- based on your experience, are you familiar with the plans that TVA and other utilities have in place for installation of pollution control equipment?

A. Yeah. I'm familiar with TVA's plan, and I'm familiar with a number of other utilities. Not every one, but a number of other utilities.

Q. And how are you familiar with TVA's activities in this

area? Can you summarize for us what you've looked at to prepare your conclusions in this case?

A. Yes. First, there's a lot of publicly available data on Department of Energy, their website; Environmental Protection Agency, their websites; reports that have been prepared; TVA's own data on its website.

There is information that's been provided by TVA. Some of it we -- a lot of it we received initially, but we didn't get their plan until a later point.

I've had the opportunity to visit four of TVA's plants. And if go up on the left map there, I've been to John Sevier, Bull Run, Kingston and Widows Creek, those four plants.

I had a chance to sit through depositions of some of TVA's witnesses. And Mr. Bynum, I guess isn't a witness, but head of the fossil operations --

MR. GOODSTEIN: Yes. There has been some testimony submitted from Mr. Bynum's deposition in our deposition designations, Your Honor, but I understand he's not going to be a live witness at trial.

THE COURT: All right.

BY MR. GOODSTEIN:

Q. What else have you done to reach your conclusions in this case, Dr. Staudt?

A. Well, I thought about the technologies that are available, the capabilities of the industry to provide. I

also thought about what's happening at other utilities in other states that I'm familiar with. And so, in forming my conclusions, I tried to compare what TVA is doing to what some of these other utilities are doing.

And that's essentially what, you know, and in trying to set as a baseline what is, my opinion, good practice in terms of reducing emissions from coal-fired power plants.

Q. And you looked at some data from the Institute of Clean Air Companies. You've also looked at available data from the USEPA.

A. USEPA, yes. USEPA -- in addition to the Institute of Clean Air Companies, USEPA -- it was very interesting -- prior to issuing the Clean Air Interstate Rule, they made projections of how many scrubbers were going to be installed, and they thought they needed -- they projected about 70,000 megawatts by 2015.

In early 2007, EPA updated that and said, by 2010, they'll have about 80,000 megawatts of scrubbers installed. So, in reality, the industry was able to respond and companies were able to put controls in place much faster than was anticipated a number of years ago when EPA formulated the Clean Air Interstate Rule.

Q. Have you also reviewed and analyzed information from the Utility Air Resources Group?

A. Yes, I have.

Q. And can you describe for us what that group -- what their members are and how they're comprised?

A. Yes. The Utility Air Resources Group -- I think it's Utility Air Regulatory Group.

Q. I'm sorry.

A. It's a -- It'll tell you it's an advocacy group for the electric utility -- for a number of electric utilities. Some of the big utilities, like Southern Company, are members. I think probably ADP is a member, and a few other -- I don't know if Duke and Progress are maybe members as well.

They have hired consultants to do analysis and provide comment to EPA on the Clean Air Interstate Rule, and I've had a chance to examine what they provided to USEPA in their analysis.

Q. And you've also looked at quite a bit of data regarding the Tennessee Valley Authority and their coal-fired power plants?

A. Yes, I have.

Q. And you've looked at data that was available from TVA's submissions to the U.S. Department of Energy?

A. Yes, I did.

Q. Can you describe a little bit about those databases that are publicly available based on TVA's reporting requirements to the U.S. Department of Energy?

A. Yes. The utilities are required to submit, regularly,

information to U.S. Department of Energy, information that describes the equipment that's at their plants, the operation of their plants, generation by units, capacity, a lot of information on fuels, and these are in things called Form 767. Well, now there's a new form, but the old form is Form 767 and Form 423. I don't know the numbers of the new forms because they changed their reporting a year or so ago.

So 767 has a lot of information that you can -- you can download from the Energy Information Administration's website. It's a, you know, huge series of Microsoft Excel worksheets that have data on every power plant in the country and it's submitted annually and updated each year.

Form 423 is data on all of the fuel contracts. It includes quantity, heat input, sulfur content, things like the cost. Companies like TVA provide the 423 data. Deregulated utilities -- an example would be Midwest Generating in Illinois -- they don't submit 423 data because in a deregulated market they don't want to give up information on what their fuel costs are. But these are the sort of things that --

Q. So it's fair to say you have a pretty extensive database from publicly available sources that you relied on in this case?

A. Yes. Yes. And in addition is data from USEPA on emissions. So between the information on -- from Energy

Information Administration and USEPA, you can get a pretty good picture of what's happening and what's happened at plants in a period of time.

Q. And the sources of information that you've just described in your testimony that you've reviewed and analyzed for the purposes of this case, those are the typical, standard sources of data and information that experts like yourself in the field of air pollution controls and costs review and rely on and analyze when they look at issues?

A. Yes. Yes. And, in fact, the data is provided by the companies themselves. You know, the data on TVA is actually submitted by TVA to EPA or Department of Energy, and, similarly, for other utilities. They submit their data each year. The EPA data is submitted quarterly but the DOE data, Department of Energy data, is submitted on an annual basis.

Q. And that data is certified by the companies; is that right?

A. Well, I'm not sure about the exact procedure, but...

Q. But they're responding to reporting requirements --

A. They are responding.

Q. -- of the USEPA and the U.S. Department of Energy?

A. Yeah, they're responding -- certainly, the EPA data is very carefully scrutinized, and emissions data and the DOE data is -- they're responding to a requirement, the government requirement to supply this data.

Q. So these are official submissions of data --

A. These are official submissions of data.

Q. -- that you rely on?

A. That's correct, yes.

Q. And you've also reviewed the record in this case pretty extensively?

A. Yes, I have.

Q. Can you tell us a little bit about the types of information that have been exchanged in discovery here in this case that you've had an opportunity to review?

A. Well, there's been extensive data -- information regarding the type of equipment TVA has installed on its plants. Much of that is also contained in the Energy Information Administration's submittals as well.

I've been able to review TVA's plans for their future -- what they call their plan for -- long-range plan for compliance. And that's changed a couple of times, but I've had an opportunity to examine that. Had an opportunity to examine expert reports produced by some of TVA's witnesses as well.

Q. And you've looked at interrogatory responses and --

A. Yes, inter -- there were, yeah. There were a series of interrogatory responses where there were questions and then TVA provided answers to those questions.

Q. And the documents that have been introduced, you've had

an opportunity to review those?

A. Yes. Yes, I have.

Q. And you also mentioned earlier that you've gone to several plants on site visits. Can you just give a summary of what you looked at when you went out to the plants that you visited?

A. When we went to the plants that -- went to four plants. The first one we visited was Kingston, and with the Kingston plant, we -- we took a look at -- we basically did what engineers call more or less of a walk down of the plant, where you walk over the major pieces of equipment.

We spent a fair amount of time discussing -- with a presentation by some of the plant people on their scrubber project at Kingston. We had a chance to look at the boilers, the SCRs, to stand on top of the ESP and look down at where the scrubber construction was starting. And we had a general explanation of some of the things that are done at Kingston. Kingston blends fuel, so they have fuel in two coal piles and kind of mix it together to get the best mix to try to reduce sulfur.

Went to Bull Run. Had an opportunity to walk down that plant as well and -- with the plant manager, had an opportunity to see the SCR that was installed a few years ago, and also take a look at the site where they're building the scrubber for the Bull Run plant as well.

The next plant we went to was -- I think John Sevier was the one we saw before Widows Creek. John Sevier, the same thing. We went and visited the plant. They don't have a scrubber and SCR. TVA has indicated that it plans to install that technology at John Sevier in the future. But we did get an opportunity to see the plant, to see where the scrubber would be if it's installed in the future.

And Widows Creek. Widows Creek is interesting because it's almost like two plants side by side. Widows Creek 1 through 6 are the older units. They're smaller. So we walked around Widows Creek 1 through 6, got a chance to examine those units, then went over to Widows Creek 7 and 8.

And our main interest was, you know, because we'd already had a chance to see boilers and whatnot, mainly to look at the scrubbers because the other plant visits didn't have an operating scrubber. So we had a chance to take a look at the scrubbers that were installed at Widows Creek 7 and 8.

Q. And referring your attention, Dr. Staudt, to Exhibit 79, which is now in evidence, which is the photo that's on the easel in front of you --

A. Yes.

Q. -- can you describe what that shot shows?

A. Well, if you -- the smokestack on the left is Widows Creek 7, and if you -- when I drove from the airport to

Asheville, I drove past Progress's Asheville plant, and you would see a puffy -- that puffy cloud from the Asheville plant. And this is the same sort of thing. That's -- it's actually good. I mean, that's just water vapor coming out. That means it's been through a scrubber and most of the pollution has been removed.

Widows Creek 8 is -- the stack on the right is -- that Paradise 1 and Paradise 2 are -- they use -- they don't have a dedicated particulate control device, which is pretty unusual. Most power plants in the U.S. have dedicated particulate control devices. You would never see one built today without a dedicated particulate control device. And we'll discuss these technologies a little bit later.

They happen to have their -- so they use their scrubber to remove the primary particulate, which basically is the coal that doesn't burn, and, if not captured, just goes up the smokestack as particles. They happened to have their scrubber bypassed at the time and so the particulate -- so the gas was going out of the -- bypassing the scrubber, so you were getting the full SO2 and the full particulate coming out of the stack at that moment, and that's what that kind of brownish cloud is.

Q. So what you see on the right, the smokestack in that photo, is the basically untreated emissions?

A. That's correct. That's correct. It's essentially

untreated. There is no -- there is no air pollution control devices. There's no way to tell if the SCR was in operation at that time, but it probably wasn't because it was in April and it was before the ozone season.

MR. LANCASTER: Objection; speculation. He just said there was no way to tell, probably wasn't. He doesn't have a foundation of knowledge.

THE COURT: Well, sustained.

BY MR. GOODSTEIN:

Q. Dr. Staudt, do you know what time of the year, what season that the SCRs are operated at TVA coal-fired power plants?

A. Yes. TVA operates its SCRs at its coal-fired power plants during the ozone season and not at other times.

Q. And when is that?

A. That is from May 1st through the end of September.

Q. So TVA has SCR technology installed on some units in its system, and they don't operate those year round?

A. That's correct.

Q. Why not?

A. They're not required to.

Q. Dr. Staudt, have you reached some conclusions about whether or not emissions from TVA coal-fired power plants, air pollution emissions, are currently at a reasonable rate, based on your experience as an air pollution control

engineer?

A. Yes, I do have an opinion.

Q. Can you tell us, please, what your conclusions are?

A. My conclusion is that their emissions are at an unreasonable rate, and I believe that they should take -- the responsible thing to do would be to take some action to reduce those emissions at a faster rate than they currently plan to.

Q. Can you summarize for us the basis for that conclusion?

A. As discussed earlier, I've had a chance to think about what other -- I know what other -- what has happened in other states and with other utilities, what the technologies are capable of and, in my opinion, these plants emit emissions well in excess of what is being done by other utilities that have -- that have taken action, or at least they're taking action that are getting their emissions at a much more reasonable rate.

Q. And what were the benchmarks that you used in drawing your conclusion?

MR. LANCASTER: Your Honor, may I take the witness on a brief voir dire as a basis of his knowledge?

He testified at his deposition that he had not made any calculations of emission rates for neighboring utilities.

MR. GOODSTEIN: Your Honor, obviously, we'd like to continue and examine our witness and we'll pass --

THE COURT: Yes, I'll let the examination continue, and the cross-examination can show any deficiencies, I take it, that you have in mind.

MR. LANCASTER: Thank you, Your Honor. If I may simply note my objection for lack of foundation.

THE COURT: Yes.

THE WITNESS: My opinion is based upon looking at the Clean Smokestacks Act and the emission rates that would be required for the Clean Smokestacks Act.

But I'm also familiar with what's -- with what the State of Illinois has required of its three major system operators to reduce their emissions, and it's fair to say that all of these -- all of these utilities would not have had these requirements if their historical emissions were fine. The State stepped in because they needed to get them down to reasonable levels. Similarly, for the State of Georgia, that has a technology-based standard that's requiring Georgia Power to install scrubbers.

So my basis is, as a benchmark, I used equivalent -- emissions rates that were equivalent to what would be required in the Clean Smokestacks Act in 2013, and using those equivalent emission rates, I developed what would be caps for TVA, and my opinion is that their emissions are well in excess of those caps.

Q. And did you develop some output-based emission levels?

A. Yes, I did. I used -- I looked at -- I looked at the -- I used the requirements of the Clean Smokestacks Act, and, from them, using projections to 2013, using the USEPA's projections of generation and heat input, I developed a projected output-based emissions rate in pounds per megawatt hour. Using that output-based emissions rate and USEPA's projections for TVA's operation in 2013, I developed an equivalent emission cap for the TVA system.

Q. I'd like to show you Plaintiff's Exhibit 95 for identification.

If we can put that up on the screen, please.

Is this a summary that you prepared, Dr. Staudt?

A. Yes, it is.

Q. And what does it show?

A. This shows output-based system-wide emission limits that I developed for TVA's system. And it shows that, in my calculations, the reasonable cap for TVA would be about 60,000 tons of NOx and about 140,000 tons of SO2 per year.

Q. And how did you develop these output-based emission levels?

A. I examined -- I examined the emissions levels that Duke and Progress are required -- are held to under the Clean Smokestacks Act, and developed an equivalent emission, output-based emission rate based upon USEPA's projections in -- projections for the future, and using 2013 as the year.

Then I took that emissions rate, and using a projected generation for TVA, developed the caps.

MR. GOODSTEIN: Your Honor, we offer Exhibit 95 into evidence at this time.

MR. LANCASTER: Your Honor, we object to Exhibit 95 as being outside of the scope of this witness' expertise. His expertise is air pollution control engineering and cost analysis.

To prepare this exhibit, he performed electricity generation projections for both Duke Energy and Progress Energy for the year 2013 to come up with the emissions rates, and he also made electricity generation projections for TVA for the year 2013.

He testified at his deposition that he has no training or experience in electricity generation forecasting, so we object to this as simply being outside the scope of his expertise.

THE COURT: All right. Objection overruled. Exception for the defendant.

MR. GOODSTEIN: Thank you, Your Honor.

BY MR. GOODSTEIN:

Q. Dr. Staudt, you mentioned that you used 2013 as an appropriate deadline for the output-based emission levels that you developed.

A. Yes, I did.

Q. Can you explain to us why you used 2013?

A. There are two reasons. One is, it is consistent with the Clean Smokestacks Act final deadline, but the Clean Smokestacks Act also has interim dates that, frankly, would have been too early to achieve. Obviously, 2007 -- imposing a 2007 NOx deadline on TVA, we would have already passed that one. So we looked out and determined that this was a date in the future that was achievable and consistent with the objective of reducing emissions as quickly as we believe it's feasible.

Q. So based on your experience in the field of pollution control engineering, you've concluded that TVA could achieve these reasonable levels of emissions by 2013.

A. Yes. Yes. And in addition to that, examined in my initial report, I formulated one possible approach to getting emissions below these levels, and it showed that using well-accepted, understood technology that TVA already uses at some of its -- number of its plants, it could get -- it could get emissions below these levels.

Furthermore, I identified that if TVA took some measures to improve the operation of some of their existing scrubbers that are not providing the type of emissions reduction that a modern scrubber could provide, they took measures to improve the operation of those scrubbers, they could actually mitigate the need to install as many scrubbers as under the

scheme that -- the approach that I originally outlined in my report.

And I identified in my original report the units that could be scrubbed, what the emissions rates could be, and I also identified ways -- those approaches that TVA might use to less expensively get some emissions reduction.

Q. All right. You made reference to your reports, Dr. Staudt. They should be in the back of your binder.

A. Yes, they are.

Q. Can you identify your expert disclosure reports on this case as Plaintiff's Exhibit 461 and 462?

A. Yes, this is them.

Q. These summarize your analysis and your conclusions in this case?

A. Yes, they do.

Q. As well as your background and experience?

A. Yes, they do. Yes.

MR. GOODSTEIN: Your Honor, we've marked these for identification. There is a motion in limine pending that was filed by the State of North Carolina.

TVA has identified all their expert reports as trial exhibits. These reports, from our perspective, Your Honor, contain some inadmissible hearsay. Some of them have been prepared by individuals other than a testifying individual. They contain some data that's been provided by

contractors, for example, and hasn't been properly quality controlled by TVA. So we filed a motion in limine, Your Honor, on behalf of the State of North Carolina to exclude those expert reports.

We have a number of experts who are coming in from out of town to testify on behalf of the State of North Carolina, so we didn't want them to leave town without identifying their reports for the record and laying the foundation, so if Your Honor decides that expert reports are going to be received into evidence, we would offer them at that time. But for right now, we're just marking these for identification.

THE COURT: They're not being offered except for identification purposes?

MR. GOODSTEIN: Yes. We're going to mark them for identification, Your Honor, and lay the foundation, and if Your Honor decides to receive expert reports, as we indicated in our submission, we would like to have the opportunity to offer ours on behalf of the State of North Carolina, if that's the ruling, Your Honor.

But we think the case is better presented, more effectively presented without admitting expert reports, and we're prepared to put our experts on and have them lay the foundations for their data summaries and their figures and tables, but not include the text of their expert report,

which we think is better left out of the record since you're going to have live testimony which describes their analysis.

THE COURT: Let me hear from TVA.

MR. LANCASTER: Your Honor, our position, as set forth in our response to the motion in limine, is that it would make a lot of sense in a case like this to admit the expert reports of experts who actually appear and testify supplementary to their testimony.

The Court is already well aware from only a little over a day, this trial involves very technical areas and quite a few different very technical areas.

Just about every expert report that was submitted by both sides contain a good bit of background information on the fields at issue, they summarize the opinions of the witnesses. We believe it would be helpful to the Court to have those available as the Court decides this case, subject, of course, to the same kinds of objections that were made to the testimony when it was presented from the stand, not in lieu of the key testimony, but supplementary, and certainly to allow the parties to move a little more quickly over some areas that may be some background or not as necessary to explain fully from the stand, more easily explained, perhaps, in the written version.

That's why we marked our expert reports as exhibits. We do not intend to offer any of the expert

reports from any witnesses who do not testify. And the issues that Mr. Goodstein raised about supposedly one of our reports having bad information in it, it's already come out in the form of another motion in limine that specifically addresses that very issue, and, of course, that one would be coming in subject to that objection.

But our view is that the -- it would be helpful to the Court to have those reports, but I believe from my understanding of trial practice, after the plaintiff rests, it may be too late for them to offer theirs. If ours are not going to be objected to and admitted -- if they will be admitted and not objected to when they're offered, then we would have no objection to the plaintiff's reports, but if ours are to be excluded, we would request that theirs be excluded, too.

THE COURT: All right.

MR. GOODSTEIN: Your Honor, we have this issue with a number of TVA's expert reports, not just one, and we have full faith that this Court will give all the weight to that evidence that it deserves, and we're prepared to proceed at the Court's pleasure, but we did file a motion in limine and we do object to the admission of TVA's expert reports because of the hearsay and multiple levels of hearsay and unreliable data analysis that's contained in them.

But we're prepared to proceed at the Court's

pleasure either way. We've had ours marked for identification in case the ruling is that expert reports are going to be received.

THE COURT: I will rule on them as they're presented, I take it, is the best approach.

MR. GOODSTEIN: Okay. Thank you, Your Honor.

THE COURT: Yes. You're not offering at this time, Exhibits 461 and 462?

MR. GOODSTEIN: Not right now, Your Honor.

THE COURT: Okay.

BY MR. GOODSTEIN:

Q. Dr. Staudt, can you describe a little bit about what you know regarding the TVA system and when the plants were put into operation and the vintage, if you will, of the power plants and the TVA coal-fired fleet and how that -- how it's comprised, please, in relation to your conclusions?

A. Yes.

TVA operates one of the largest coal fleets in the country, 11 plants altogether, seven in Tennessee, two in the southern part of Kentucky, two in the northern part of Alabama. They have 59 units. And what that means is that at each power plant there are multiple generators and multiple boilers.

For example, at Johnsonville, they have ten generators and ten boilers. At Bull Run, they have one boiler and one

generator. So they have 59 units altogether. Of those 59 units, 40 of them are at least 50 years old, and, therefore -- and all of them are at least 35 years old.

So they were largely built prior to us knowing what we know about air pollution today and knowing what we know about how to burn coal and control the air pollution from coal. So as a result, over time, it's been necessary for TVA to try to bring its coal-fired plants up to modern standards. So it should not be surprising that when we talk about TVA's plants that we'll see that they've had to add equipment over time.

The other thing or characteristics of TVA's plants, 43 of the units are 200 megawatts or less, because, in those days, 50 years ago, people built generally small units, and so a big portion of their capacity is tied up in relatively small generating units. And what that does, it affects how all of these -- when you're trying to control pollution, and if you're under a -- trying to do it on a system-wide basis or under an averaging type of plan, what it means is that if you're very reliant on small units, you have to add a lot of equipment to those small units. If you're under -- if most of your generating capacity is tied up in very large units, you can -- you may be able to just control the very big units and not have to do as much with the smaller units.

Another feature, the way the plants are situated, you can see that there are four plants, John Sevier, Bull Run,

Kingston and Widows Creek, who are on the eastern -- you know, on the eastern part of their system and are close to mountain regions. And we heard yesterday about some of the concerns about pollution that's affecting the mountain regions.

Q. And are you familiar, Dr. Staudt, with the air pollution control technologies that are at issue in this case?

A. Yes. Yes, I am.

Q. And how are you familiar with those, in summary?

A. Well, as discussed earlier -- oh, I'm familiar with the technologies based upon an extensive amount of experience in working in the field in general, but as they apply to TVA's plants, that's as a result of reviewing all the information that we discussed earlier, public information, visiting the plants, information provided by TVA, and the reports.

Q. And have you had an opportunity to compare TVA's current emission rates with the reasonable emissions caps that you've developed?

A. Yes. Yes, I have.

Q. And what did you conclude when you compared their current emission rates to the reasonable emission rates that you developed for their system?

A. When I compared them, they are well in excess.

Q. And did you prepare a summary --

A. Yes, I did.

Q. -- of that comparison?

A. Yes.

Q. I'd like to show you, Dr. Staudt, Plaintiff's Exhibit 52 for identification. Is this the summary you prepared?

A. Yes, it is.

Q. Can you tell us how you prepared this summary?

A. There are three rows of information here. And the 2000, we see NOx and SO2 emissions. What I see, a CSA target underneath NOx is a 1.19 pound per megawatt hour, that's basically what I determined to be a reasonable emission rate based on an equivalency to the Clean Smokestacks Act.

Q. You can touch that screen and point, if you would, since there's a lot of information on this.

A. Oh, so people can see it.

And then, similarly, for SO2, I developed an equivalent output-based emissions rate.

Q. And how did you develop that rate?

A. That was using USEPA's growth projections.

Mr. Lancaster raised an objection. I didn't do the projections. I used USEPA's projections. So I utilized their projections. So I used their projections for growth in generation and to develop what a future generation level would be.

Q. And those growth estimates were from USEPA's IPM model?

A. Yes, the integrated planning model. And it's a model

that USEPA uses to evaluate the entire electric utility system. It's been used -- was used to develop allocations for NOx allowances under the NOx SIP Call, and so it's -- the advantage of using IPM is that it's a -- it's a method that is publicly -- the results are publicly available. Some of it is independent. It had information on both TVA, but also Duke and Progress. It had projections for all of those utilities, so I didn't have to go around trying to mix and match information from different sources -- mix and match information from different sources.

And, finally, it's a method that has been scrutinized very, very carefully, even in the courtroom, and the methodology has been upheld. So it's a methodology that is easy for me to point to and say, This is a proven and tested methodology.

Q. And is that a standard source of growth rates in your field?

A. Yes. I mean, that's -- well, that's -- for this purpose, for the purpose of establishing emissions allocations, it's something that USEPA has used. So it's a pretty standard approach.

Q. And you determined that those growth projections provided by the IPM model, which is maintained by USEPA, that those were reasonable --

A. Yes.

Q. -- estimates of growth?

A. Yes. What they did show, a higher growth rate in North Carolina than for the Tennessee Valley Authority system. However, those growth rates are consistent, at least, with what we see the utilities themselves -- planning for themselves, Duke and Progress. Duke is wanting to build 1600 megawatts of new coal generation. They did get 800 megawatts approved.

TVA is not planning any new coal generation and, you know, they're looking at reducing -- reducing generations on some of their units. So it's -- the difference in growth rate is consistent with what -- with what the utilities themselves appear to be doing.

Q. So based on what's happening on the ground, what were you able to conclude based on your experience about the growth rates that you used from USEPA's IPM model?

A. I believe that they were reasonable growth rates.

Q. Reasonably accurate estimates of what's going to happen in the future?

A. Well, whenever you're making -- whenever you're trying to make an estimate of what happens in the future, there's some uncertainty, but it certainly also cuts both ways. But, yes, it's a -- it's a proven, tested method and that has been very carefully scrutinized and used in policy making.

Q. Okay. And how did growth -- first of all, maybe you can

describe for us specifically how growth is used -- that term is used for this type of analysis in pollution control engineering, and then how you used it in your analysis in this case.

A. Yes. Under an emissions cap, a utility that is having to grow its generation would have to continue to reduce the emissions rate from its generating units. Reducing emissions rate is -- can be -- is a measure of how -- the cost, effort, and expense associated with keeping emissions low. So as a general approach, what has been used in -- what was used in the NOx SIP Call was an effort to try to make it sort of -- equilibrate emission rates across regions so that no one location had to be penalized too much.

I'll give you sort of an extreme example from the early 1990s. At the time when ozone transport was of great concern, we had the opportunity -- Mr. Nicholson presented some graphs yesterday, and if you took a careful look at those graphs and where all the pollution went, it all seemed to head up towards New Jersey for some reason.

And I remember in 1990 -- in the early '90s, seeing modeling results that show that even if everything were shut off in the state of New Jersey that they would still not attain the ozone standard because of all the pollution that just came in across their border. So I don't think anyone would argue that it would be reasonable to say that New

Jersey should shut down before people in Pennsylvania should control their pollution, or people in Maryland or upwind states.

So it gets to the point of trying to share the responsibility of reducing emissions across regions because, recognizing that pollution, unfortunately, doesn't stop at the border, it crosses the border.

MR. LANCASTER: Your Honor, I didn't realize that's what he was going to say because the question -- he spoke rather narratively. But I would like to move to strike that.

The gentleman testified at his deposition that he is not an expert on impacts of pollution, that once it goes out of the smokestack, he's not an expert on what happens to it, and I believe that's outside -- this testimony about impacts of pollution are outside his expertise in air pollution control engineering.

THE COURT: Overruled.

THE WITNESS: So this just goes back to the notion of that -- that's why EPA has tried to establish emission rates across regions when they tried to allocate NOx allowances and SIP Call.

BY MR. GOODSTEIN:

Q. And of course, what would happen if these caps on the easel right there were imposed on TVA's system today? What would be the effect of that on TVA's system?

A. Well, today they would be well in excess of that.
Q. And how would -- what would be the only way they could comply with those caps today?
A. Well, if they were -- if those caps were applied to TVA's system, it would be necessary for them to not only complete the projects that they have in the pipeline, but to accelerate their long-range plan that, what I've determined, is likely to get them there, if accelerated.
Q. But what you looked at is whether they could get there by 2013, right?
A. Yes.
Q. If these caps were to be imposed on TVA's system today, they would have to shut down, wouldn't they?
A. Yeah. They'd have to shut down --
Q. They couldn't continue to operate --
A. Yeah, they wouldn't be able to operate many units.
Q. Right. So one of the reasons you looked at 2013, as you said earlier, was to give them a reasonable amount of time to install the additional control devices or make other operational changes to meet these caps, right?
A. That's correct. We obviously couldn't impose it today because it would be quite a disruption for TVA.
Q. And if you're looking at a year in the future, would your analysis be as complete if you didn't consider growth, growth of demand for electricity?

A. Yes. You have to -- it would not be complete if you didn't consider growth because -- in fact, as Mr. -- one of TVA's expert witnesses, Mr. Scott, testified that they factored growth into their plan. Growth is something that obviously is considered, because that's one of the reasons why EPA uses the integrated planning model, to help them with those projections. So you have to factor growth into developing allowance caps, or emissions caps.

Q. Can you describe what else you did to compare TVA's emissions with the reasonable emission rates that you determined for their system?

A. Well --

Q. And you can refer to Plaintiff's Exhibit 52 for identification, which is in front of you.

A. Yes. Well, you can see at the bottom line -- that probably blacks it out. But these numbers are the result of the -- bottom line are the result of a strategy that I employed, employing technologies on TVA's units to reduce emissions to under those caps. That convinced me that it's technically feasible, using well-established technology that, in fact, TVA uses on many of its units.

What I also did is formulated a base case based upon what's installed and what's likely to happen in the future.

You see here that there is a reduction in SO2 emissions from 2005 projected based upon installing -- that

incorporates some growth in generation. It also incorporates Paradise 3 scrubber, which would reduce emissions. And then we have here, for NOx, projection for NOx emissions, that, in light of developments last Friday, may be too low, because the assumption in my NOx projection was that TVA would operate its existing SCRs annually in response to the Clean Air Interstate Rule. That rule having been vacated, my opinion is that it's unlikely that TVA will operate those SCRs annually since there won't be a requirement to do so.

And the way I came up with what I call a 2013 base case, the assumption was equipment that is installed and operating. And right now -- I made this projection in 2006, couple years ago, without having seen TVA's plan, and lo and behold, the equipment that is -- that I assumed to be in operation then is in operation today, and the equipment that is not -- I did not assume to be -- that I assumed would not be in operation, then, is not in operation today. So in terms of the equipment configuration, it was -- it was on the mark.

TVA has made some progress since the beginning of this lawsuit at reducing its emissions in other ways. Some coal changes. Mr. Lancaster, in his opening statement, discussed some of the reductions, and I think it's a clear sign that, motivated, TVA is capable of reducing its emissions, and my opinion is that they ought to intend to do more faster.

Q. And is there anything about the reasonable emission rate

caps that you developed that would keep TVA from installing emissions controls at a faster rate?

A. No. In fact, it would provide more motivation, if anything. You know, the benefit of a cap is that -- a legal cap, a legal requirement, is that, first, it makes the emissions reductions certain.

TVA, after I produced this, eventually produced their plan, which was -- they kept confidential. It was confidential for a while. And the dilemma with the plan is, even though it ultimately gets them close to where I think they ought to be, it takes a very, very long time.

Second, it's highly uncertain, as Mr. Bynum testified in his deposition, one thing is for sure, the plan will change.

Finally, the plan is premised on federal requirements that don't exist anymore, and absent those requirements, it's hard to imagine without another requirement imposed, either by this Court or some other, someone else with authority, TVA isn't going to speed that plan up.

Q. Is there anything about the system-wide caps that you developed, Dr. Staudt, that would prevent TVA or discourage them from completing the projects they currently have under way to install additional pollution control devices on their plants?

A. No. On the contrary, it would motivate them, create interest motivation. I mean, it's completely consistent with

what they're doing now to get some of their scrubbers installed and would provide them with motivation to complete them as well as others.

Q. And, in fact, to the extent they've got some projects under way that will reduce their emissions, how does that affect the work left to do, the installations left to do to meet these caps?

A. The fact that TVA has been making progress on some of these scrubbers, Bull Run, Kingston, and hopefully we'll see more progress on John Sevier -- the fact that TVA has been making some progress, reduces the amount of additional effort that's necessary to close the gap with what these reasonable emission rates would be.

Q. And how will emissions caps, based on your experience, affect the operation and maintenance -- continued operation and maintenance of pollution control devices that are installed?

A. It provides a great motivation to ensure that those scrubbers and SCRs and whatnot are maintained properly and are also operated and not bypassed.

As we saw in the photo, TVA does periodically bypass the scrubbers. Sometimes that may be a necessary part of their operation. But, obviously, you want to minimize that, and if you have a cap, that provides a real motivation to keep that bypassing of a scrubber as minimal as possible.

Q. And is this the way the Clean Smokestacks Act, for example, is structured in North Carolina?
A. Yes. The Clean Smokestacks Act imposes a, you know, a cap, so there's a lot of motivation for both Duke and Progress to ensure that the equipment that they install continues to operate and is maintained so that it continues to provide the best performance possible.
Q. And in that case, in the case of the Clean Smokestacks Act in North Carolina, did Duke and Progress agree to those caps?
A. I think Mr. -- I believe they did. There was testimony yesterday to that effect, so I wasn't -- they did agree to those caps. That's my understanding.
Q. And would there be a reason why a utility like TVA would rather have a system-wide cap than the specific requirement to install specific controls at a specific plant?
A. Yes. By and large, utilities -- the best way for -- the best way for a utility to reduce its emissions is to be told what the target emissions are and to leave it up to them to find the best way to get there, because if you try to impose unit-by-unit technology, sometimes it's better -- you can get better results for less money if the utility just -- they know their plant better than anyone else, so it's best for them to try to find the best way to get to the goal. So a system-wide cap enables them that flexibility.

Q. So a cap on a system or a group of plants is something that provides the utility some operational flexibility?
A. Oh, that's right. Yes. Yes. Because what they can do is they can put the controls where they believe they'll be most beneficial.
Q. And you came up with a control scenario actually looking unit by unit at the TVA system; is that right?
A. That's correct.
Q. And that's how you developed these caps?
A. That is correct, yes.
Q. So you looked unit by unit and applied these controls, in large part, that TVA already has, the types of controls that they already have utilized on some areas.
A. That's right. Used scrubbers, flue gas desulfurization. And there are different types -- limestone forced oxidation systems, which are the type of scrubbers that TVA has on a number of its units already. I assumed SCR on some units and I assumed SNCR, which is a less expensive technology that doesn't provide quite as much reduction on some other units. And TVA has SCRs installed, 21 of them, I believe, and they've been testing some SNCR systems.
Q. So part of your determination was that there were available controls that TVA has already utilized that could be installed to meet the caps by --
A. And these are controls that not only TVA has utilized;

they're used throughout the utility industry. You know, Duke and Progress are installing a lot of scrubbers. In fact, they have, I believe, now more capacity scrubbed than TVA, and in just a few short years.

So, in addition to that, nationwide, scrubbers are being installed. Georgia Power is installing a number of scrubbers, both Advatech scrubbers, which are the type TVA is installing Shiota scrubbers. Throughout the country, there are scrubbers being installed, so this is a very standard technology.

Selective Catalytic Reduction is another very standard technology. It's used on about 200 coal-fired utility boilers. So these are an established group of technologies.

MR. GOODSTEIN: Can we put up Plaintiff's 59 for identification, please?

BY MR. GOODSTEIN:

Q. Dr. Staudt, I want you to describe for us how these control devices work that you looked at in assessing whether or not TVA could put on additional controls to reduce sulfur dioxide and NOx emissions by 2013 to the levels you've developed for reasonable emission rates.

A. What I'd like to do is explain, using, if I could, this slide here showed -- I could can explain how a power plant works, not pollution --

Q. Yeah. If you could just briefly, since most of us don't

have much experience with coal-fired power plants, if you could just briefly describe how the process works, the generation of these emissions, and then the process of electric generation, and then what control devices are readily available to reduce the pollutants and the flue gas before it's emitted.

A. Yes. Using this figure, you can see on the left, it's where the coal is. That coal is the source of energy. It contains a lot of chemical energy.

It travels by conveyor to the furnace, where it's burned; and the flames, the burning, produces heat. And in the boiler there, you turn -- high-pressure water is pumped up to a high pressure, into a very high-pressure steam, and that high pressure steam finds its way -- is piped over to a steam turbine.

The high pressure steam turns the steam turbine, which, in turn, turns a generator, which produces electricity, and, eventually, that electricity finds its way to the wall sockets and light bulbs and whatnot.

So this is a summary of how the electricity is produced.

Now, looking at that boiler, you see there is combustion going on inside that boiler. The hot gases, it -- this doesn't show any pollution control devices.

Q. This is a simplified diagram.

A. This is a simplified diagram. Yeah, so this is just --

Q. What happens to the flue gas?

A. The flue gas essentially goes up the stack, so -- but what you want to do before it goes up the stack is you want to remove some of the pollution.

MR. GOODSTEIN: We offer Exhibit 59 into evidence, Your Honor. I don't believe there is any objection.

MR. LANCASTER: No objection.

THE COURT: All right. Let it be admitted.

(Plaintiff's Exhibit No. 59 received.)

BY MR. GOODSTEIN:

Q. Referring your attention to Plaintiff's Exhibit 61, Dr. Staudt.

A. Yes.

Q. Is this another simplified diagram of a coal-fired steam generator out of your report?

A. Yes. A steam generator -- just to acquaint people with the terminology, a boiler and a steam generator are the same thing. They call it a steam generator because it generates steam. Doesn't generate electricity; it generates steam.

Now, you can see here it identifies where the burners are, here and here, and that's where the coal and the combustion air are emitted to the furnace. There is a flame zone right in the center inside this big box, and -- what I also want to do is I want to show -- there is a person -- just to give you a sense of how big some of these things are,

there is a person there, to give you a sense of how big these boilers can sometimes be.

Q. So this gives you a sense of a scale --

A. A scale.

Q. -- of these boilers?

A. These are pretty big devices. Lot of steel. And after the combustion and the flame zone, hot gases pass up -- pass up, and they'll actually travel like this (indicating).

Now, what happens is, as those hot gases pass up and through, they release heat to the walls of the furnace. And the walls are made out of steel tubes that are filled with water, and that water inside gets heated up and turned into steam. The steam is further heated in these heat exchangers up here, which are superheater and reheater. And so you basically -- the gas is heated up in the combustion zone and then it gets cooled.

The whole purpose of the steam generator is to take that heat out of the hot gases and create steam, high-pressure steam.

MR. GOODSTEIN: We offer Plaintiff's Exhibit 61 into evidence, Your Honor. I don't believe there is any objection.

MR. LANCASTER: No objection, sir.

THE COURT: Let it be admitted.

(Plaintiff's Exhibit No. 61 received.)

BY MR. GOODSTEIN:

Q. And, Dr. Staudt, when you were at the Kingston plant on your site visit, did you have an opportunity to get a couple coal samples from the Kingston plant?

A. Yes, the. Folks from TVA very politely allowed us to take some coal from the Kingston plant.

MR. GOODSTEIN: Your Honor, with your permission, I'd like to approach the witness and have him identify this coal sample, please.

THE COURT: All right.

MR. GOODSTEIN: Plaintiff's Exhibit 60 for identification.

THE COURT: You may do so.

BY MR. GOODSTEIN:

Q. Dr. Staudt, is that the sample of coal that you were able to get at the Kingston plant?

A. That appears to be that, the very same one.

Q. Free of charge?

A. Free of charge.

MR. GOODSTEIN: Your Honor, we offer Plaintiff's Exhibit 60 into evidence at this time. I don't believe there is any objection.

MR. LANCASTER: No objection, sir.

THE COURT: Let it be admitted.

(Plaintiff's Exhibit No. 60 received.)

MR. GOODSTEIN: And, Your Honor, if you'd like to take a look at this, I'll hand it up.

(Exhibit 60 tendered to the Court.)

BY MR. GOODSTEIN:

Q. So Dr. Staudt, can you explain for us what types of coal are in this sample and what else is in the coal besides the material, the BTUs that are combusted and generate the electricity?

A. Well, the coal arrives on site in big chunks, as you can see from this one big chunk, and then once it arrives on site, you don't burn it in these big chunks; first you need to crush it. And there is some crushed coal here. And you crush it down to pieces that are maybe a half inch, inch in size.

Some boilers actually will burn that crushed coal, but most boilers have to grind it into a very fine powder to make it burn efficiently.

Now, coal being a -- it's a great resource. It's the most abundant resource -- energy resource in the United States. Where it comes from is out of the ground, and because it comes out of the ground, unfortunately, it contains a few things in there that we really -- you know, we really wish it didn't have. Those things include sulfur, they include mercury and other things that can contribute to air pollution, if you -- if you don't try to make an effort

to control it.

Q. Dr. Staudt, do you think you could provide us a quick summary of the pollutants that you address when you design pollution control equipment for coal-fired power plants and what control devices reduce those pollutants?

A. Yes, I could.

MR. GOODSTEIN: Your Honor, with the Court's permission, I'd like to have Dr. Staudt approach the pad so he can do a short summary for us.

THE COURT: All right.

(Witness steps down.)

THE WITNESS: There are four pollutants of real concern at a power plant, so I'm going to describe what the pollutants are.

BY MR. GOODSTEIN:

Q. Why is it a concern?

And Dr. Staudt, for the court reporter's benefit, if you could write and then speak her direction, I think the record would be clearer.

A. Thank you. I apologize.

Q. Sure.

A. And then, finally, I'll also describe how we control these pollutants.

The first pollutant is actually what you can see coming out of that smokestack there. It's primary PM. Primary

particulate matter. It's the part of the coal that doesn't burn. Coal is a solid material and part of it doesn't burn, and if you don't catch it, it's going to go up the stack. So I'm going to call that PM. It's also referred to as opacity at times.

The reason PM is a concern is because it can deposit and cause property damage and be a nuisance.

MR. LANCASTER: Your Honor, may I stand over here where I can see and hear him a little better?

THE COURT: Sure.

MR. LANCASTER: At this podium over here?

THE COURT: Fine. Come right up here closer.

THE WITNESS: The other concern is it can be an indicator for other pollutants. Sorry, I'm writing -- I'm going to write small. I don't want to run out of space.

It can be an indicator for other pollutants, and being that sometimes mercury can get attached to this, to the PM, and that's why it's good to have a particulate control device, because if there's mercury on that particulate, the particulate control device will catch it.

The other thing is, as you can see there, that meant the scrubber was being bypassed, so there's more SO2 than you would like going up the stack.

But the way PM is controlled, there's a device called an electrostatic precipitator, abbreviation ESP. And

ESP charges the particles, collects them on plates, and it's the most common control device for particulate on power plants.

The other thing is a fabric filter, also called a bag house. It removes the particles much like a vacuum cleaner does. It's got the fabric, the gas passes through the fabric and it catches it.

In some cases, very few cases, a scrubber may be used.

Okay. So that's one -- one pollutant.

Another pollutant is SO2. SO2 is a concern for a couple of reasons. One is acid deposition. And we heard testimony yesterday about acid deposition.

Another concern is fine particulate and what's called secondary PM. It doesn't go up the stack as a particle, but because of chemical reactions that occur at a later time, these fine particles are created. And that fine PM is a concern from the perspective of visibility and also in terms of health. It's a concern for health because they can be inhaled deeply.

Now, the way to control SO2, one is to reduce the sulfur of the coal. I put "S," just the abbreviation for sulfur. The other approach is -- I'm going to use just a general term, scrubber. Now, there are different types of scrubbers, but if you don't reduce the sulfur in the fuel, the other way

to get it out is to catch it later on.

There's another technology that is being used at a couple of the Duke and Progress plants called furnace sorbent injection, which also -- it's the abbreviated FSI. And that doesn't get quite as much reduction as a scrubber, maybe about 50 percent, but it also doesn't cost as much.

The other pollutant of concern is NOx. NOx is formed during the combustion process. There's nitrogen in the fuel in coal that oxidizes to form NOx. There's also nitrogen in the combustion air. Close to 79 percent of the air we breathe and that goes into the furnace to be used in the combustion process is nitrogen, and a small portion of that gets oxidized to form NOx.

That's a concern for a number of reasons, all of these reasons for SO2, okay: Acid deposition, fine PM, okay, which is visibility and health. But also it contributes to ground-level ozone, also commonly known as smog. The way to control NOx is using -- is either to -- first of all, usually the least expensive way to do it and the first choice in most cases is combustion controls. Things like low-NOx burners that TVA has, units with low-NOx burners. And that's a commonly used technology. So I'll put combustion controls. So, essentially, you control the combustion, the way the coal is burned to try to minimize the oxidation of the fuel nitrogen and the oxygen in the air that creates the NOx. So

there are ways that you can carefully control that combustion process to try to minimize the formation.

The other approach is -- because in many cases you can only go so far with combustion controls and you run into the limitations. Like the problem with combustion is that really efficient combustion also tends to make high NOx because of high temperatures and whatnot. So you run into limitations for combustion controls.

You use post-combustion controls to get additional reductions. Those include -- you've heard me say SCR, selective catalytic reduction, and SNCR, selective non-catalytic reduction. And we'll discuss them a little bit more in detail. Those are the commonly used post-combustion controls.

The final pollutant is mercury. Mercury is a concern because it's toxic. As other people will testify, it has ways of getting into the food chain, and it's, therefore, a health concern. Fortunately, some of these controls used for other pollution also happen to capture mercury.

I mentioned that mercury can get deposited on this particulate, the primary particulate. Well, if you have an ESP, some of that mercury, the part that deposits on the particulate, gets captured by the ESP.

A scrubber. We also know a scrubber is very good at capturing some forms of mercury, but if the gaseous mercury

is in a particular form, it can be very easily captured by a wet scrubber. So these are called co-benefit. Okay. Co-benefits. Okay. And by co-benefits, we have a scrubber that's used to reduce SO2, and it doesn't only get SO2, it helps us get mercury as well. And the scrubber used in combination with an SCR helps to get even more mercury than a scrubber by itself because the SCR will help to put the mercury in a form that is easily -- more easily captured by the scrubber. There are also mercury specific technologies, but we're not going to go into detail here.

So this hopefully gives the Court kind of an overview of some of the pollutants that are -- that come from power plants, why they're a concern, and what we do to try to control them.

THE COURT: All right. At this time, we'll take our morning recess, and then we'll call you back to the stand, Dr. Staudt.

THE WITNESS: Thank you, Your Honor.

THE COURT: Recess for 15 minutes.

(Recess.)

* * * * *

THE COURT: All right. Let's continue the examination.

MR. GOODSTEIN: Thank you, Your Honor.

We want to offer 483 into evidence, Your Honor. It's the pad summary marked for identification.

MR. LANCASTER: Your Honor, I have no objection if it's only for illustrative purposes, but I have the same objection, if it's meant to be substantive evidence, that the gentleman's expertise does not cover the impacts as listed on the chart.

THE COURT: All right. What exhibit number are you giving it?

THE WITNESS: It's Exhibit 483 for identification, Your Honor.

THE COURT: 483?

MR. GOODSTEIN: Yes.

THE COURT: All right. Let it be admitted for illustrative purposes to illustrate the testimony of the witness as explained during the course of the drafting of the document.

(Plaintiff's Exhibit No. 483 received.)

MR. GOODSTEIN: Thank you, Your Honor.

BY MR. GOODSTEIN:

Q. Dr. Staudt, if I can refer your attention to Plaintiff's Exhibit 65.

If we could put that up on the screen, please.

Is this another schematic out of your report, Dr. Staudt?

A. Yes, it is.

MR. GOODSTEIN: We'll offer Plaintiff's Exhibit 65 into evidence, Your Honor.

MR. LANCASTER: No objection.

THE COURT: All right.

(Plaintiff's Exhibit No. 65 received.)

BY MR. GOODSTEIN:

Q. Dr. Staudt, can you explain what this schematic shows, please?

A. Yes. This shows a schematic diagram of a coal-fired boiler with some pollution control equipment.

You may recall that I had a diagram of the steam generator earlier. You can see that's this device here.

Q. So the furnace is on the left? That's the boiler?

A. Yes. And we already discussed this, so -- but after that furnace, the gas passes through a series of heat exchangers, and this shows -- this device here is called -- is what I referred to earlier as the ESP. It says "precipitator" on it.

Q. Yes.

A. That precipitator is a -- that captures the particulate, and then this device here, called the absorber module --

Q. Yes.

A. -- that is where -- that is where the SO2 is captured in the wet scrubber.

So an absorber module is the part of the wet scrubber where the gas passes through and it comes in contact with the reagent that captures the SO2. And then you can see the gas passes to the stack.

So this is an example of how a coal-fired power plant would look with the -- including some of the air pollution control equipment that we've been talking about. It shows how -- you know, the relative sizes. And, as you can see, this equipment is fairly large, but it's a routine and important part of using coal in a power plant.

Q. And this particular schematic shows the precipitator and shows the scrubber, as identified on here?

A. That's correct.

Q. The absorber module. So this flue gas is going from left to right on the schematic --

A. That is true.

Q. -- through the control device and out the stack?

A. I apologize if I didn't make it clear.

The gas starts at the furnace. Then it passes down through these heat exchangers, goes through this device, through the air heater, air preheater -- it's another heat exchanger -- then goes to the precipitator, then goes to the

absorber module, and then goes up the stack.

Q. And this particular schematic doesn't have an SCR on it, but, if it did, can you show us where it would be located?

A. It would be located in this location, roughly, because an SCR needs to operate in a particular temperature range of the gas that happens to be at that location. So it has to be upstream of that last heat exchanger, called the air heater.

Q. Okay. Let's turn now to Plaintiff's Exhibit 71, please.

Is this another schematic from your report?

A. Yes, this is another schematic of my report, and it actually shows how an SCR would be installed on a coal-fired boiler.

You can see, again, here's the furnace; the gas starts here; it goes through these heat exchangers, then passes through this ammonia injection grid. Ammonia is added because ammonia is the chemical that reacts with the NOx to reduce it to nitrogen and water as it passes through the catalyst bed, which is contained within this structure there that I put the arrow on.

And these, again, are -- it's equipment that is required on every new coal-fired power plant and it is retrofit on, you know, hundreds of coal-fired units nationwide.

Q. Dr. Staudt, you had an opportunity on your site visits to see a number of these control devices, scrubbers and SCRs in action and currently installed?

A. Yes. We had a chance to see some of the pollution control equipment at these facilities.

Q. And you also had a chance to look at some of the construction of new controls that are under way since this lawsuit has been filed?

A. That's correct, yes. Yes, some of the scrubbers that are under construction.

MR. GOODSTEIN: I'll offer Exhibit 71 into evidence at this time, Your Honor. I don't believe there is any objection.

MR. LANCASTER: There's no objection, Your Honor.

THE COURT: All right. Let that be admitted.

(Plaintiff's Exhibit No. 71 received.)

BY MR. GOODSTEIN:

Q. And then, Dr. Staudt, we have some photographs of the various types of pollution control devices that you had a chance to look at and maybe are familiar with in your work, and maybe we could run through these and you can just tell us what they show, starting with Plaintiff's Exhibit 66.

A. This shows the -- this is a photo taken during our site visit to the John Sevier power plant, and what you can see to the right here, this is -- the boiler is inside that building. The gas comes out into -- this is the electrostatic precipitator, and then that collects the particle matter, and then the gas passes into the smokestack

and out the chimney. That's where it's released.
Q. And this was a photograph that was taken the day you were out at the John Sevier plant in 2007?
A. That is correct. That's correct.
Q. And Plaintiff's Exhibit 68, can you identify that?
A. Yes. This is a photo taken during my site visit to the Kingston plant, and it shows one of the ESPs to the Kingston plant.
There's a long duct that comes from where the boiler is located, and that -- the gas passes from that duct into the ESP and then into the chimneys.
Now, we'll see in a minute the other end of this duct when we see the photo of the SCR.
But these facilities, Kingston and John Sevier, the ESPs were built in the '70s and the plants were built in the '50s, so these ESPs were -- these were not original. These particular ESPs are not original to the plant.
Q. Is it unusual to have to retrofit a coal-fired power plant of this vintage?
A. No, it's not unusual because, as I mentioned earlier, plants that came in service in the '50s, they were built before we knew what we know now about air pollution and how to control it. So in the intervening years, it's been determined that we need to put controls on these plants. So in order to continue to make good use of these facilities,

without releasing a lot of pollution, it's been necessary to add additional control devices.

Q. All right. And in some cases, does that involve a change out of the chimney stack?

A. Yeah. You frequent -- it's not unusual to have to add a new chimney. More often than not, the remaining chimney is typically the old -- usually, you'll have to add -- if you add a scrubber, you typically have to add a chimney, and sometimes if you add other equipment, you may have to add a chimney. It's not uncommon, though, to leave the old chimney in place because it's kind of difficult to knock it down.

So what you'll see in many of these plants are a lot of chimneys that are not in service anymore because improvements have been made to the plant and the old chimneys have been retired.

Q. So when we went out to these plants for the site visits, at some of these plants, Kingston, for example, there were several sets of chimneys there?

A. Yes. Yes.

Q. Is that unusual?

A. No, that's not unusual. You can see there are two chimneys here. These are the existing operating chimneys here and here. There is also another set of chimneys for each boiler that have been retired a number of years ago, but they don't -- they're just still standing there.

Now, after Kingston completes their scrubber, these two chimneys will be taken out of service and they'll be using the chimney for the scrubbers, the new chimneys.

Q. That's my next question.

So as part of the retrofits for scrubbers and other pollution control devices, it's not unusual to have to install a new chimney associated with that?

A. No, it's not unusual.

Q. I want to show you Plaintiff's Exhibit 73 for identification. And can you explain to us what this photograph shows?

A. Well, this is the other end of that ductwork. You can see -- this is the boiler house at Kingston, and here is an SCR. The gas passes up and down through that SCR. So this is the SCR right here. You can see this is an old chimney right here, another one here, here, another one here. And so those chimneys aren't in service anymore. (Indicating on exhibit.)

The gas passes in that direction to the ESP that we just saw in the previous photo. So this is the other end of that long duct that we just showed. And as it shows these -- you know, TVA has retrofit SCRs at Kingston. They're capable of doing that. They've done it in the past, and the SCRs are working.

It's not uncommon at power plants to have to retrofit

these -- retrofit their older coal generation with equipment like SCRs and scrubbers.

Q. And the configuration can differ somewhat, at least on the plant layout.

A. Yeah, every --

Q. But is a retrofit usually available for the coal-fired units that you encounter, in your experience?

A. Yes. The -- every plant has its unique layout and aspects to how to fit this equipment in there. Now, bearing in mind, you're often dealing with a plant, with a piece of equipment. You're trying to fit a piece of equipment into a location where it wasn't originally designed to accommodate that piece of equipment, and sometimes you have to move some things around in order to fit the equipment in. Each plant may take a slightly different approach to doing it, but it can be done.

And, you know, TVA has retrofit SCRs on 21 units, so they've shown that, despite all those different -- all the differences, they're able to do that.

Q. And, for example, in this photo, Plaintiff's Exhibit 73 for identification, they've retrofitted on the Kingston plant SCRs, and Kingston is a multi-unit plant, right?

A. Yes. There are actually nine boilers sitting right in a row, which presents its own challenges in terms of how to retrofit the boilers that are in the middle.

And so it's -- you know, there's a set of challenges, but luckily we have a lot of smart engineers that, you know -- not just at TVA, but also with the companies that supply this equipment, and they're able to figure out ways to do it.

Q. And TVA was also able to retrofit the Bull Run plant, for example, which is a large, single-unit plant -- they were able to retrofit that with SCRs.

A. Yes.

Q. Is that right?

A. Yes. So you can see that's roughly the two extremes, the large, single-unit plant versus Kingston, which is a plant with nine small units side by side.

Q. Let's look at your photograph of Widows Creek units 7 and 8, which is Plaintiff's Exhibit 74 for identification.

Can you tell us what that shows?

A. Well, that's a photo -- we are actually standing on top of the roof of Widows Creek 1 through 6.

As you may recall, I described Widows Creek as almost like two plants next to each other. What you can see here, this is the coal conveyor. The coal travels along that conveyor, it goes into bunkers, and then it's used in the boiler to burn, and the gas passes up.

What we can see here, these are SCRs that were added probably in the 2002-2003 time range. You know, this plant

has been here for a while, so it wasn't originally designed with SCRs, so what the engineers had to do is install the SCRs in the right place, and they built this steel here to put the SCRs up in that, up in the proper location.

You can also see here, this back here is where the scrubbers are located. So the gas passes after the SCR, goes down through some heat exchanger equipment, finds its way to the scrubber, and then goes to the chimney.

Q. Referring your attention to Plaintiff's Exhibit 75, is this the SCR installation at Bull Run that we referred to a little earlier?

A. That's correct. This is -- this photo was taken -- again, was taken during the site visit at the Bull Run power plant. This is the coal conveyor here. Okay. The boiler house is here. So the coal is being -- it's conveyed up to the boiler house, where it's burned in the boiler. The SCR is located right there. And gas passes out of the boiler, goes up here, over and then down, and actually passes down -- let me clear this. I made a mess here -- passes down and then goes back.

There's, if you can see -- look carefully. There's a blue duct there. It passes back to the ESP; ESP collects the particle matter; and then from the ESP, it goes to the chimney right there.

This device here is not -- it's really just an elevator.

It's not part of the SCR. It's just an elevator so you can go up to the top of the SCR.

So in this case, Bull Run, they had an existing horizontal shaft heat exchanger, which I don't expect people to understand, but what it means -- what happens is, it's not the ideal type of configuration that you want when you have an SCR. You really want to have a vertical shaft heat exchanger because the gas passes down. So what they had to do -- and also the heated -- the Lungstrom heat exchanger was an older one, so they replaced it and then put -- that caused this to be built up a little bit higher than it might otherwise have been necessary because they had to accommodate the air preheater that was underneath it.

MR. GOODSTEIN: At this time, Your Honor, we offer Plaintiff's Exhibits 66, 68, 73, 74 and 75 into evidence, and I don't believe there is any objection.

MR. LANCASTER: That is correct, Your Honor.

THE COURT: All right. Let those be admitted.

(Plaintiff's Exhibit Nos. 66, 68, 73, 74 & 75 received.)

MR. GOODSTEIN: Thank you, Your Honor.

BY MR. GOODSTEIN:

Q. So Dr. Staudt, TVA has been able to install SCRs at a number of its facilities?

A. Yes, they have.

Q. And has it been your experience with these older coal-fired power plants that they've been able to accommodate SCR technology one way or another with an appropriate retrofit?
A. Yes. By and large, they have, and, as I noted earlier, each specific plant has its unique issues, but, by and large, it's been possible to retrofit these plants with SCR.
Q. And, Dr. Staudt, are you familiar with the typical schedule, typical time period required for the installation of the SCR technology on an existing coal-fired boiler?
A. Yes, I am.
Q. And based on your experience, approximately how long does it take to install your typical SCR?
A. Typically, an SCR can be installed in under two years. I've seen it actually done in under a year, but that was -- that was public service in New Hampshire's Merrimack station. That's probably -- most people would probably end up being 18 months to two years.
Q. Has the USEPA published a particular schedule for the retrofit of SCR? Are you familiar with their published schedule?
A. Yes. There is a report that I was an author to, issued in 2002, where we -- it was -- the purpose was to evaluate engineering and economic factors associated with multi-pollutant control strategies, and it was really focused

on evaluating the resources necessary to comply with President Bush's proposed Clean Skies Act. And so we -- we examined the availability of resources, but also the timing of projects, to see whether or not only if -- if resources were available to perform these projects, how much time would be necessary for the industry to respond.

Q. And did you include a typical schedule for a retrofit of an SCR on an existing coal-fired unit in your report in this case?

A. Yes, I did.

Q. I'm going to show you Plaintiff's Exhibit 77 for identification. And is that the SCR installation schedule that you included in your report?

A. Yes, I did.

Q. And did you develop this schedule for the USEPA?

A. Yes, I did.

Q. Can you tell us briefly how you developed it?

A. This was developed in collaboration with getting information from the people who build SCRs, the Institute of Clean Air Companies and also specific companies within that organization that provided us input on what the key parts of the -- key elements of the construction period would be and how long it would take on a typical basis, recognizing that, you know, it could sometimes be done shorter.

As I mentioned, Merrimack was done in a year, which they

were under a very, very tough deadline and they managed to do it in under a year. But, typically, this is what you would see.

Q. And the schedule that's in Plaintiff's Exhibit 77, was that published in an official report of the USEPA?

A. Yes, it was, in 2002, October of 2002.

MR. GOODSTEIN: Your Honor, we've provided a copy of that report to counsel and they're familiar with the schedule. It was disclosed some time ago in Dr. Staudt's report, and so we'd like to offer it into evidence at this time.

MR. LANCASTER: Your Honor, Mr. Goodstein is correct, he did provide me just today with the report that he's talking about. It's a rather lengthy report. I have not had time to review it.

I would have no objection to the admission of this document if the entire report were admitted under Rule 106 that requires other material all be considered with excerpted material. The document does appear to have some explanations about these schedules.

THE COURT: So let me understand your objection, then. You have no objection to this Exhibit 77, but you --

MR. LANCASTER: Yes, sir. Mr. Goodstein has handed me a certified, gold-sealed, true and correct copy from the EPA of the entire report, and I would not have an objection

to that coming in, but I would have an objection to portions coming in out of context.

MR. GOODSTEIN: Your Honor, we've received excerpts from official government reports in this trial already, and if counsel wants to admit portions of it, I think that would be something that we could consider at the time when he's offering it, but right now, we're just offering this schedule which Dr. Staudt prepared and which was included in his expert report, and it was disclosed to the TVA lawyers some time ago.

THE COURT: All right. I'm going to admit Plaintiff's Exhibit 77, and the further explanations, as you propose it. I will hear the objections --

MR. GOODSTEIN: Thank you, Your Honor.

THE COURT: -- perhaps as to the admissibility of the parts, but as to this exhibit then, the Court's ruling is it's admitted.

MR. GOODSTEIN: Thank you, Your Honor.

THE COURT: Yes.

(Plaintiff's Exhibit No. 77 received.)

BY MR. GOODSTEIN:

Q. Dr. Staudt, do you have a similar schedule for implementation of FGD or scrubber projects that you included in your report in this case?

A. Yes, I did.

Q. And I'd like to refer your attention to Plaintiff's Exhibit 83 for identification. Is this it?
A. Yes, it is.
MR. GOODSTEIN: Your Honor, we'd offer Plaintiff's Exhibit 83 into evidence at this time. It's the same foundation.
MR. LANCASTER: We have our same objection. It's an incomplete document.
THE COURT: All right. Let 78 be admitted.
MR. GOODSTEIN: 83, Your Honor. I'm sorry.
THE COURT: 83?
MR. GOODSTEIN: Yes. We had 77, and then the other schedule for retrofits of the scrubbers is marked for identification as Plaintiff's Exhibit 83.
THE COURT: Yes. I see it now. 83.
MR. GOODSTEIN: Thank you, Your Honor.
THE COURT: Let that be admitted.
(Plaintiff's Exhibit No. 83 received.)
BY MR. GOODSTEIN:
Q. And can you tell us, Dr. Staudt, what a typical scrubber project schedule is, in terms of months?
A. Well, they'll vary, but, typically, it can be done within three years, two to three years. And what it -- all these projects involve an engineering phase, they involve a procurement phase, on-site construction, construction that is

necessary for hooking the device up, and whether it's an SCR or a scrubber, it's important to bear in mind that the construction -- the vast majority of the construction activities don't interfere with the operation of the plant. It's only when -- during that period where they have to make connections to the ductwork, and it will vary somewhat based upon the particular circumstances, but it might be anywhere from a month to six weeks. There might be a long outage of about a month to six weeks, but, typically, you try to schedule those outages during a normally scheduled outage.

Power plants, on a routine basis every year or so have a longer outage to do to routine maintenance activities, turbine -- you know, turbine refurbishment or other repairs to the boiler. So you'll typically try to schedule the hookup outage during that time so it has a minimal impact on the plant operation.

Q. So there's a design period and permit obtaining period, and then there's a period of installation, and then there's a period of hookup?

A. Yes.

Q. Which can be done during the plant's normal outages?

A. That's correct. And what I -- each situation is a little bit unique because you have to deal with the particular plant schedule, you have to deal with particular plant configuration, but you can do a lot of -- I've seen

people do the major -- do most of the hookup -- wait until they get most of everything installed and then do all the final hookup.

But, actually, what's frequently done is, just so you don't interfere with the plant's outage schedule, they'll actually do a lot of the major part of the hookup, which means cutting, removing ductwork, putting new ductwork in place and rerouting some things, and then kind of blanking things off until the rest of the project is completed, and then you do a final connection, and so it has less interference with the plant's operation.

Q. And that's true of the SCR installation that we looked at and the schedule that we looked at for SCRs earlier, and it's also true of the scrubber schedule that we're looking at now?

A. That's right. And every plant has its own particulars and they may -- you know, the engineers who run these programs, they may adjust the schedule slightly.

You know, the main thing is trying to get the outage to do the hookup, to do the major duct modifications at a point in time where it has a minimal impact with the normally scheduled plant operation, but that can generally be accommodated.

Q. In addition to SCR technology for the reduction of nitrogen oxide emissions, was there another technology that

you looked at for application of the TVA system that also reduces NOx?

A. Yes. That would be Selective Non-Catalytic Reduction technology.

Q. And referring your attention to Plaintiff's Exhibit 78, can you describe for us how the SNCR technology differs from SCR, and in what situations is it appropriate to use SNCR versus SCR?

A. An SCR can get 90 percent removal of NOx. But as you can see, there's a large piece of equipment there and so it's -- you know, the cost is the cost is high relative to some other technologies that don't get as much NOx reduction.

If you're trying to get a lower amount of NOx reduction, you use a technology called SNCR. And that level of reduction will vary for the particular facility, but it's typically in the range of 20, 30, 40 percent reduction in NOx emissions.

The advantage of it is it's a very simple technology to install and put in place. As you can see from here, which is a very simplified diagram of an SNCR system, you have a delivery system. Basically, a tank car comes, delivers urea or ammonia on site. It goes into a storage tank. There are pumps that pump the urea up to the side to the boiler just through pipes, and there are small holes in the side of the boiler, penetrations in the furnace wall, where you just

spray the urea in and the urea will react with the NOx in a similar manner that you get the reaction with SCR, but it's at a higher temperature so it's just not as effective.

The advantage of this is it's much less expensive, maybe about a tenth -- in capital cost, maybe about a tenth of the price of an SCR system. On the other hand, it doesn't get quite as much NOx removal. So what you would frequently do -- and, finally, it's a lot less intrusive in terms of installing it. You just need to install these boiler wall penetrations, and you do have to shut the boiler down to do that, but in my experience, I've seen that done within a week. So that's very easy to accommodate into a plant schedule.

And these can be installed anywhere -- certainly, well within a year, and, you know, six months -- I've seen them done in six months from the date the decision is made to it starting up and operating.

The reason you might use it is if it's a plant that you don't want to spend a lot of money on in order to get 90 percent NOx removal. So, for example, if you've got an older plant that you're uncertain about how -- what its future lifetime is, you don't want to tie up a lot of capital but you do want to get some level of NOx reduction, you might consider SNCR.

Q. And what are the relative removal efficiencies,

approximately, of an SCR versus an SNCR?

A. An SCR will remove 90 percent of the NOx, typically. Close to it. The SNCR, it will vary based upon the particular unit anywhere from, say, about 20 percent to about 40 percent. I've seen in some cases higher, but that 20 to 40 percent is probably a number to sort of use as a reasonable range.

Q. Okay. And what are the other methods available to TVA to reduce NOx emissions from its coal-fired power plants in the next four years to achieve the caps that you've determined would be reasonable emission levels for that?

A. There are a couple of approaches besides SCR and SNCR. One could be -- well, increased use of Powder River Basin coal. Powder River Basin coal has a low fuel nitrogen content and as a result it will -- in addition to having a low sulfur content and produce low SO2 emissions, it also tends to produce low NOx emissions.

Other things that could be done is, you know, if you're under a system-wide cap, you can choose to -- you know, if you have uncontrolled units, you just don't operate them as much as you operate your controlled units because the uncontrolled units will -- for each unit of electricity, they're going to produce more pollution. So you tend to -- you can make operating choices that favor the more controlled units.

Finally, there are some things you can do with a combustion system. They tend to be limited. They'll get you to a certain point but perhaps not as far as you need to go. But there are a number of different ways to consider, not just SCR and SNCR.

Q. So TVA has a number of options to achieve the output-based emission levels, these reasonable emission rates that you've determined they could achieve by 2013, in particular, the NOx levels.

A. Yes. And that's the advantage of having a cap, is because it leaves the utility the flexibility to decide for themselves what's the best way to get under the cap, rather than saying you've got to install this here and that there or having an emission rate for each and every unit.

So a system-wide cap is a good way to go because you get the reductions but you also provide the utility the flexibility to use the approach that they think works best for them.

Q. Now I'd like to talk about the sulfur dioxide reduction technologies and approaches that are available to TVA to achieve the sulfur dioxide reasonable emission rate that you've determined.

A. Yes.

Q. And I'll refer your attention to Plaintiff's Exhibit 81. And is this a schematic, another schematic out of your

report?

A. Yes. What this shows is an absorber, the internals of a scrubber, a wet scrubber. And you see the gas here. You can see where the gas comes in over here. The SO2 and the flue gas come in, and then they come into this big -- most scrubber designs, I'll say, are cylindrical in shape. Most the companies that build these make them cylindrical. And there are others that are not cylindrical, like the Advatech scrubbers that TVA are using, but they all use pretty much the same principle. It's just a matter of geometry.

The gas comes in, it passes up through here and then out here (indicating). In the process of doing that, you've got these recycle pumps that pump slurry around from the bottom up, and then it -- so the gas, as it's passing up here, up here, comes into contact with the limestone slurry, and then chemical reaction occurs where the SO2 gets absorbed by the limestone.

Down in here is the -- they've got -- it's a forced oxidation tank. It's an oxidation tank. And you have here little -- it says slurry agitators. That's to keep stuff mixed up. And they also blow air into here to help convert into, finally, to gypsum, which is calcium sulfate.

Now, keep in mind that this is just kind of what the scrubbers work -- the way all scrubbers work. You'll see -- you'll have an image of the Advatech scrubber. It's just a

different shape, but it uses the same principle.

And these scrubbers can get 98 percent removal of SO2. And what that means is, if you were burning an Illinois basin coal that has -- without a scrubber or any other control device, it would produce five pounds of sulfur for every million BTUs of fuel input. You could get .1 pounds of sulfur, or a million BTU, output. So it can get in that range, 97, 98. I've seen permits written with 99 percent removal required. So these can get a very high level of SO2 removal.

Q. And were you able to see some of the scrubbers that are currently installed at some of the TVA units that you visited?

A. Yes. We saw scrubbers that were in operation at Widows Creek and we also saw scrubbers under construction at Kingston and at Bull Run.

Q. And what are the other types of technologies that are available to TVA to reduce sulfur dioxide emissions?

A. One of them is, of course, going to a lower sulfur fuel. And TVA has done some of that. Generally, the lowest sulfur domestic fuel is from the Powder River Basin, and that emits, you know, depending upon, you know, the particulate delivery, .5 to .6 pound-per-million BTU, as compared to an Illinois basin high-sulfur fuel of about 5 pound-per-million BTU fuel. There's also Appalachian coals that are washed that get to

about 1.25 pound-per-million BTU fuel.

The other possibility is furnace sorbent injection, which is kind of like SNCR. You're just injecting sorbent into the furnace and you get some reaction. It's not a real expensive approach. You can get, perhaps -- depending upon the sorbent you use, you can get, perhaps, around 50 percent removal. So you can imagine if you're using an Appalachian coal with about a 1.25 pound-per-million BTU sulfur content, if you use furnace sorbent injection, which isn't that expensive, you might be able to get your SO2 emissions down to about .6 pound-per-million BTU.

And then, finally, the other choice is an operational choice, and that is, you know, choosing to operate controlled units in favor of uncontrolled ones, so you minimize the operation of your uncontrolled units.

Q. So based on your experience, Dr. Staudt, if these emission limits that you've determined to be reasonable emission levels for TVA's system by 2013, if these were imposed on TVA as a result of this proceeding, is this going to require TVA to close down operation of any of its coal-fired power plants?

A. You said by 2013?

Q. Yeah.

A. No. No.

And I just recalled there's another technology that I

forgot. It's called dry scrubber. Dry FGD. Most often, that gets over 90 percent removal of SO_2. It's -- it's not quite as costly as wet scrubbers, not quite as big as wet scrubbers, and where I've seen it used are on -- typically it's on -- if you're burning another, say, a washed Appalachian coal at 1.25-pound-per-million BTU, you can get under .1 pound per million BTU --

(Interrupted by court reporter.)

A. If you're burning coal with an SO_2 emission level of 1.2 pound-per-million BTU, you can get an outlet emission rate with this technology of under .1 pound-per-million BTU because it'll get over 90 percent removal. And usually it's not used with high-sulfur coals because it uses hydrated lime rather than limestone, and hydrated lime is more costly than limestone.

Q. So you have wet scrubbers; you have dry scrubbers; you have these operational changes --

A. And furnace sorbent injection.

Q. -- which you mentioned earlier.

A. Yeah.

Q. So, in summary, are the limits that you developed, these reasonable emission rates for TVA's coal-fired power fleet by 2013, are they going to require TVA to close down any of its coal-fired power plants?

A. No, they won't require them to do it. TVA may make a

choice; that's up to them. But there's no reason that they would have to shut down plants in order to meet these limits.

Q. So based on your experience, they can continue to operate the plants they have with an acceleration of retrofits and other modifications in the operations of these plants to achieve these emission rates by 2013?

A. That's correct. They can achieve these emission rates by 2013.

Q. And you've seen and it's documented that TVA has installed the types of controlled technologies that you've described on coal-fired units that they currently have, and they've been operating effectively with those additional control devices installed?

A. Yes. And not just TVA, but other power plants. Other coal-fired power plants have used those technologies very successfully. So these are technologies that, not only TVA, but everyone has -- most people in this industry have a lot of experience with. There shouldn't be any reason why they can't be applied.

Q. And are they readily available to TVA?

A. Yes. Yes.

Q. So turning your attention to Plaintiff's Exhibit 82, is this a photograph of an installed FGD or scrubber unit at TVA?

A. Well, this is a photo of a part of the scrubber. You

remember that photo of the absorber before. I showed that tank at the bottom where you have spargers, you inject air, and it converts the... (inaudible) --

(Interrupted by court reporter.)

A. They just blow air in and they mix it up. And what this does, the older scrubber designs had that tank separate from the absorber. So Widows Creek has some older scrubbers.

This is interesting from the perspective of you get to look inside and see that this tank is all about. It's basically, you know, water and slurry with air being blown in and agitated, and you're trying to convert the calcium sulfite -- the calcium sulfate, which is gypsum, which is the final product. So this is basically an element of the scrubber that, because the Widows Creek scrubbers are older, it's external, whereas a new scrubber would be internal.

Q. So a scrubber is basically a treatment tank?

A. Well, part of it is, yes. It's, you know, spray headers pumps and the treatment tank in order to get the final reaction to the gypsum.

Q. And they've been commonly installed on some TVA units and lots of other coal-fired units around the country?

A. Oh, yes. Yes.

Q. And TVA's currently, since this lawsuit has been filed, constructing some additional scrubbers?

A. Yes, they have. Yes.

Q. And you've seen some those construction operations on your site visits?
A. Yes. Yes, I have.
Q. So let me show you Defendant's Exhibit 218. Should be next in order in your book. And do you recognize this, Dr. Staudt, as one of the scrubber projects that you saw under way at the Bull Run plant?
A. Yeah. In fact, this is not the photo that I took during my site visit. This is a more recent photo that was provided by TVA to help show that they've made progress in installing the scrubber.
Q. So they've done some things on this plant since you were out there?
A. That's correct.
Q. And can you describe for us what this photograph shows?
A. What you can see here is -- here is the duct that comes -- not that last one. The duct comes over from the boiler, it goes down one side, it goes into the treatment area.
We'll have a diagram of what the internals are. But inside this building is the absorber and also are the pumps that we talked about before. And then the gas comes back out this duct and goes up the chimney here.
Q. Okay. So is this another example of an older plant that has been retrofitted with a scrubber?

A. Yes. Yes. I mean, well, yeah, Bull Run is, I think, over 40 years old, 40 or 41 years old, so by that standard, it might be old. Relative to the other TVA units, it's one of the newer facilities. But, yeah, it's -- it's a successful retrofit. Or at least -- well, it's not completed yet, but, presumably, it will be completed soon and it will be a successful retrofit.

Q. And do you know if this is one of the coal-fired power plants that's the closest to the Great Smoky Mountains National Park?

A. Yes. You can see up there on the map with the location of the Bull Run plant. You can see Kingston, Bull Run and John Sevier are all in relatively close proximity to one another and are all close to the Smoky Mountain National Park.

Q. And is there any reason, from a pollution control engineering perspective, that this scrubber couldn't have been installed sooner on the Bull Run plant?

A. I don't see why not.

Q. If it had been started sooner?

A. If it had been -- yeah. If it had been started sooner.

Q. Would it, in your experience, have been completed sooner?

A. That's what I would expect.

Q. And based on the evidence that we've seen about what the

typical scrubber project takes, as far as months to complete, again, what was that time period?

A. Well, it's -- from receipt of order, it would be two to three years, depending if you include -- if there is some additional engineering, it might go a little bit longer than that.

Q. So if this scrubber project, for example, that was studied in the late 1990s and announced in 2001, under that typical schedule, in your experience, when would that have been completed?

MR. LANCASTER: Objection, Your Honor. It's referring to facts that are not in evidence.

THE COURT: Sustained.

BY MR. GOODSTEIN:

Q. Dr. Staudt, are you familiar with the evaluation of scrubber projects by TVA in the late 1990s?

A. Yes, I am.

Q. And how are you familiar with that?

A. As part of the information that TVA provided, there was -- there were documents that describe some of the studies that they did during the 1990s to evaluate scrubbers at different plants.

Q. So based on your review of the information available in this case, was there any reason during that evaluation period in the late 1990s, from a pollution control engineer's

perspective, that TVA couldn't have started this project on the Bull Run scrubber?

MR. LANCASTER: Same objection, Your Honor. The documents he's referring to are simply cost estimating documents that were put together.

MR. GOODSTEIN: Your Honor, he asked these questions on cross-examination, but this is an expert --

THE COURT: Overruled. Go ahead. Overruled. I'll let him answer this question.

MR. GOODSTEIN: Thank you, Your Honor.

THE WITNESS: TVA could have installed this a number of years ago. Not only did TVA have cost studies in the '90s, they also had Bechtel do an engineering report. It was around 2001, 2002 or something like that. So they could have accelerated this program years ago and Bull Run would be running today, in my opinion -- or would have been running for a couple years probably, in all likelihood. TVA made the decision then to start moving ahead with the project.

Q. And do you know from your review of the record in this case approximately when TVA announced that the scrubber was going to be built at Bull Run?

A. It was around 2001 or so.

Q. Did TVA, based on your review of their records and your attendance at the depositions of TVA employees, did they study other scrubber projects in the 1990s? Did they study

other scrubber projects?
A. Besides Bull Run?
Q. Besides Bull Run.
A. Besides Bull Run, yes.
Q. In fact, there were documents that you reviewed that showed that?
A. That's correct.
Q. And they had a scrubber running at Cumberland which they used to evaluate the potential for these scrubber projects at other sites, correct?
A. Yes. Many of the cost analysis was based upon experience at Cumberland, and they used sort of scaling factors to try to estimate what the cost would be.
Q. So TVA had experience and knowledge with installation of scrubbers at their coal-fired power plants in the late 1990s?
A. Yes.
Q. At least --
A. Yes, they did.
Q. And they had experience installing the scrubbers in Cumberland?
A. Yes.
Q. And they looked at the potential for installing scrubbers at other plants?
A. Yes, they did.
Q. In the late 1990s?

A. Yes. They were examining -- they certainly were examining the cost of doing that.

Q. Will a scrubber at Bull Run dramatically reduce the sulfur dioxide emissions from that plant?

MR. LANCASTER: Your Honor, I object to the continued leading of this witness.

MR. GOODSTEIN: I'm happy to rephrase, Your Honor.

THE COURT: Go ahead. Rephrase your question.

BY MR. GOODSTEIN:

Q. How will installation of scrubber at Bull Run affect the sulfur dioxide emissions?

A. It will reduce it. Bull Run, right now, burns a coal about -- with an SO2 emission level of about 1.25 pound-per-million BTU. That's uncontrolled. So that's what the -- that's the sulfur in the coal and that's what goes up the stack.

After they install the scrubber, they can actually go to a higher sulfur coal, which will actually give them some fuel savings, in all likelihood, and -- but the other benefit is that they will be able to reduce their SO2 emissions to somewhere in the range of about .15 pound-per-million BTU. So you'll see almost -- compared to where they are now, with a 1.25 pound-per-million BTU, they'll get almost a 90 percent reduction in emissions.

Q. And approximately how many tons per year of excess

sulfur dioxide are we talking about taking out of the flue gas at Bull Run when a scrubber is installed?

MR. LANCASTER: Object to the question as "excess."

THE WITNESS: If you'll --

THE COURT: Overruled. Go ahead.

THE WITNESS: Excuse me. I'll check my -- I need to check my expert report for that number, if you don't mind.

Q. Okay.

A. It would be almost a 30,000-ton drop in SO2 emissions, in that range.

Q. And is that per year?

A. That's per year, yes.

Q. So I'm referring to the sulfur dioxide that's been emitted from this plant since -- let's say since the announcement of this scrubber in 2001 by TVA. I'm going to refer to that as the excess emissions from this plant.

Do you understand what I'm referring to, Dr. Staudt?

A. I understand what you're referring to.

MR. LANCASTER: And, Your Honor, I'd just like to note an objection to this leading questioning and argumentative questioning, and the word "excessive" is inappropriate, given that it's undisputed that the plant is in full compliance with the sulfur dioxide limits.

THE COURT: Your objection has been noted.

MR. LANCASTER: Thank you, Your Honor.

THE COURT: Yes.

BY MR. GOODSTEIN:

Q. Do you understand my question, Dr. Staudt?

A. Could you read the question back to me, please? I forgot it because of the objection.

(The pending question was read by the reporter.)

A. Yes, I do. And just -- and I'm not sure what fuels Bull Run used in the past. I assume that what they're burning now is probably at the low end of what they may have been burning in the past. I don't know if it's historically what they've burned since 2001.

So the excess emissions, as you've characterized them, might actually be higher if they actually burned a higher sulfur coal.

Q. An estimate is approximately 30,000 tons per year?

A. As an estimate, approximately 30,000 tons per year, yes.

Q. And that's been emitted into the atmosphere in that vicinity since at least 2001?

A. Yes.

Q. And TVA studied this plan and the feasibility for putting scrubbers on its plant in the late 1990s?

A. That's -- yes.

Q. And this is one of the plants that are closest to the Smoky Mountain National Park?

A. Yes, from the map, that certainly appears so, yes.

Q. I want to show you Plaintiff's Exhibit 87 for identification, please.
Dr. Staudt, does this look like the photo that was taken on the day you were out at the Bull Run plant?
A. Yes. This does appear to be the photo that I took when I was at the Bull Run plant.
Q. Okay. So the scrubber was under construction in March of 2007?
A. That's correct.
Q. And since this lawsuit was filed, they've made some substantial progress on that project?
A. It appears so.
Q. So when you compare this March, 2007, photo, Plaintiff's Exhibit 87, to what we looked at a moment ago, Defendant's Trial Exhibit 218, do you see they've made quite a bit of progress on this since this lawsuit was filed?
A. That certainly appears so, yes.
MR. GOODSTEIN: Your Honor, we'd like to offer Plaintiff's Exhibit 87 and TVA Exhibit 218 into evidence at this time.
MR. LANCASTER: No objection, certainly not to the TVA exhibit.
THE COURT: All right.
(Plaintiff's Exhibit No. 87 and Defendant's Exhibit 218 received.)

Q. You also had an opportunity to visit the Kingston plant, Dr. Staudt?
A. Yes, I did.
Q. I'm going to refer your attention to Plaintiff's Exhibit 88, please, for identification. And this is a photo that you -- that was taken the day that you were out at the Kingston plant?
A. Yes, this is a photo taken during my site visit at the Kingston plant.
Q. In March of 2007?
A. In March. Well, it says in April.
Q. Can you tell us, please, Dr. Staudt, what this photo shows?
A. What you can see here, it's relatively early stages of construction. They have some foundations in. Can see here, that is where a chimney is going in. You can see it's kind of round. And they are essentially laying -- getting a lot of the foundations and other groundwork in.
When you put in a scrubber, you often have to relocate underground utilities and things like that, so there's a lot of that site work as you put in foundations.
Q. And was the construction on the Kingston scrubber project commenced after this lawsuit was filed?
A. Yes, it was. That's the information that we've seen -- I've seen during some of the depositions.

Q. All right. And is Kingston one of the power plants in the TVA system that's closest to the Great Smoky Mountains National Park?

A. Yes, it is.

Q. And I'm going to refer your attention to Defendant's Trial Exhibit 219. And there's a cover page here, but the first photo in that exhibit, does that appear to be the Kingston scrubber project at a later date?

A. Of course I wasn't there when this photo was taken, but it appears to be -- it appears to be a photo of a scrubber, more progress -- certainly more progress having been made since my site visit.

Q. So TVA has made substantial progress on this Kingston scrubber project since this case was filed?

A. Yes, they have.

MR. GOODSTEIN: Your Honor, we offer Plaintiff's Exhibit 88 and TVA Exhibit 219 into evidence. I don't believe there is any objection.

MR. LANCASTER: There is no objection, but I do note that TVA's photographs of its plant were marked as color photographs and they don't appear to be color photographs on the screen.

Are you introducing the actual color photographs, Mr. Goodstein?

MR. GOODSTEIN: Yes. They should be in the book.

And I'm not sure why it doesn't look colorful on the screen. Washed out.

THE COURT: Let those be admitted, then.

(Plaintiff's Exhibit No. 88 and Defendant's Exhibit 219 received.)

BY MR. GOODSTEIN:

Q. Did you have an opportunity to visit the John Sevier power plant, Dr. Staudt?

A. Yes, I did.

Q. And I'd like to refer your attention to Plaintiff's Exhibit 89 for identification, which should be a color photo of the John Sevier plant.

A. Yes, that is a photo --

Q. Does that look familiar?

A. Yes. You can --

Q. That was one of the shots that was taken the day you were out there?

A. Yes, it is.

You may recall from the previous photo, here is an existing ESP, here is the existing smokestack, and the scrubber, if and when it's installed, will be somewhere -- it points up, but it's somewhere down in the back here. We've got a better view, I think, in another photo.

Q. All right. And there's another shot behind this building, I believe --

A. Yes.

Q. -- that was taken that day?

A. From standing on top of your photos -- from standing on top of the precipitator.

Q. And are you aware that TVA has announced since this lawsuit was filed that they're going to install a scrubber on the John Sevier plant?

A. Yes. It was probably about a little over a year after the lawsuit was filed, they made an announcement for the John Sevier scrubber.

Q. And did you have an opportunity to look at the site of the scrubber that was announced?

A. Yes, I did.

Q. I'll refer your attention to Plaintiff's Exhibit 90. And this should be the shot behind the building there.

Does that look familiar?

A. Yes, it does.

Q. And is that your understanding of the site of the future John Sevier scrubber project?

A. Yes. That's my understanding of where the future John Sevier scrubber will be located.

Q. All right. And then in defendant's trial exhibits, did you see any updated photographs of this particular project?

A. No, I did not.

I presumed there had been some good progress to show

that -- I would have hoped they would have provided it to us.
Q. Are you aware of any environmental assessment that's been prepared and posted for this project?
A. No.
Q. Okay. So as far as we know, this is what it looks like today?
A. That's as far as we know.
MR. LANCASTER: Objection, Your Honor. He has no foundation to know what it looks like today.
THE COURT: I'll let it in for such illustrative purposes as the testimony will support.
MR. LANCASTER: Thank you, Your Honor.
MR. GOODSTEIN: Thank you, Your Honor.
BY MR. GOODSTEIN:
Q. So we've talked about technologies, control NOx and, in particular, SCR installation, Dr. Staudt.
Are there vendors, contractors available to TVA, reputable contractors that install SCRs at existing coal-fired power plants?
A. Yes, there are.
Q. Can you name some that, based on your experience, do that type of work and are available to do the retrofits at TVA's coal-fired power plants?
A. For SCRs, we'd be looking at all the major boiler suppliers, that would include Babcock & Wilcox, Babcock

Power; even though it starts with Babcock, it's a different company than Babcock & Wilcox. There would be Austin, which has -- which is a large global company that builds power plants. Forest Wheeler. In addition, there's Hitachi, there's Lurgi. There are probably others that I can't recall. But these are all large, capable companies that have the resources and experience to install these SCR systems.

Q. What about scrubbers and flue gas desulfurization? Are there a number of vendors, reputable supply vendors that are available to do these types of projects for TVA?

A. Yes. In addition to Advatech, who is the company that TVA is working with at this time, there's Alstom, again, Babcock & Wilcox, Babcock Power. There's Siemens Wheelabrator, Hitachi, Marsulex. And I'm sure there are others that I --

Q. Black & Veatch?

A. Black & Veatch and their Shiota -- Black & Veatch.

Q. Can you tell us a little bit about the supplier that TVA currently has a contract with?

A. Yes. Advatech is a joint venture of Mitsubishi Heavy Industries, which is a large Japanese conglomerate that has scrubber technology, and they have experience with these scrubbers, a lot of it overseas. URS is the other partner in the joint venture with Mitsubishi. And URS is a large construction company in the U.S. It's one of the larger

ones. I don't know where they're exactly ranked, but they're a very large construction company.

And Advatech -- so Advatech mainly utilizes URS employees in the U.S. Mitsubishi provides the technology and know how for the process. They have sold scrubbers, not just to TVA, but they're one of the companies that installs -- is installing scrubbers for Southern Company, at a few of their plants, as well as others. They -- so they're a capable organization, even though they're a joint venture.

Q. All right. And are there a number of engineering companies that do the engineering for this type of project?

A. Yes. Yes. You would -- sometimes there's a separate engineer that actually helps the utility do some of the basic planning, sometimes before and sometimes even after they've selected who's going to supply the technology. And there are companies such as Sargent & Lundy, Burns and McDonald. URS actually does some of this, too. Washington Group, which now is part of URS.

So there's a lot of -- there are a lot of large -- Bechtel. A lot of large companies that do this.

Q. So is TVA limited in any way to its in-house engineering construction capabilities?

A. No. They have access -- you know, in the market, they have access to plenty of capabilities.

Q. And based on your experience with the Institute of Clean

Air Companies and your understanding of this market for the provision of these engineering construction services, is there anything that would limit TVA in its ability to accomplish a number of these projects in the next four years to achieve the emission rates that you've determined are reasonable emission rates for their system?

A. No, I don't see anything that would stand in their way. In fact, frankly, in light of the Clean Air Interstate Rule being vacated on Friday and some of the impacts that I discussed earlier on some of the projects and the possible impacts on some of the projects in the pipeline, it might be a very good time for TVA to look for -- to pursue these programs.

Q. So your conclusion is that there is sufficient capacity out there?

A. Oh, yes. Yes. There would be sufficient capacity even if the Clear Air Interstate Rule wasn't vacated, but particularly in light of the Clean Air Interstate Rule being vacated, I think there's going to be -- there's a good chance that there will be more people available to do the work.

Q. And can you tell us about the effectiveness of SCRs and scrubbers for the removal of mercury?

A. Yes. Used in combination, particularly if you have a particular control device, there are two to help remove the particulate mercury. You can remove over 90 percent of the

mercury when you have an SCR and wet scrubber in combination. Or even an SCR and a dry scrubber, too.

Q. Have you done estimates for the removal of mercury that you would expect to result from the additional scrubbers and SCRs that could be installed by TVA by 2013 to meet the output-based emission levels that you've developed for that?

A. Yes, I did.

Q. I want to refer your attention to Plaintiff's Exhibit 53 for identification. Is this a summary that you prepared, Dr. Staudt?

A. Yes, it is.

Q. And this was included in your expert disclosure report in this case?

A. Yes, it was.

Q. And can you tell us, briefly, the methodology you used to develop these numbers?

A. Well, you can see three columns here, one for NOx -- one for SO2, one for NOx and one for mercury. You can see the tons per year for SO2 and NOx and pounds per year for mercury.

For SO2 and NOx, these are essentially the same numbers that I think we saw on a previous exhibit. The main difference is you can see it shows here the reduction in emissions in tons of SO2 and tons of NOx and the percent reduction.

In terms of mercury, keeping in mind it's pounds per year, you have base case estimate -- and the base case estimate was -- I used as a starting point an estimate that TVA had made for its mercury emissions and then factored in growth. I also factored in the changes in control technology and the type of mercury capture that they would provide, and then arrived at the level of reduction, the emission at the level of reduction that was achievable using that approach.

Q. All right. And did you use standard, reliable methods in developing these emission estimates, based on your analysis of information available for TVA?

A. Yes, I did.

Q. And based on your experience, these are reasonable estimates of the emissions reductions that you would expect if TVA were to be required to meet the controls at the output-based emission levels?

A. Yes. I would expect something similar to this.

MR. GOODSTEIN: Your Honor, we offer Plaintiff's Exhibit 53 into evidence at this time.

THE COURT: Let it be admitted.

(Plaintiff's Exhibit No. 53 received.)

BY MR. GOODSTEIN:

Q. So, Dr. Staudt, can you explain what emissions reductions are shown on this table that you've estimated would result from the implementation of the output based

emission level caps that you've developed?

A. Yes. Comparing the base case estimate to the CSA equivalent estimate, you can see that we would get about a 310,000-ton reduction in SO2 emissions, about a 70 percent reduction. For NOx, you would see about a 55,000 ton -- however, I do want to add that in light of CAIR being vacated, that 115,000 ton-per-year base case estimate is probably optimistically low because a premise of that was that TVA would operate its SCRs on a year-round basis, and in light of CAIR being vacated, I don't see any motivation for TVA to do that. So that would likely be significantly higher, closer to possibly around 200,000 tons of a base case.

Q. Your base case estimate, Dr. Staudt, that's --

A. Oh, excuse me.

Q. I'm sorry.

A. Yeah. Base case assumes that, going forward, they comply with CAIR, which has been vacated.

Q. Your base case estimate, that is reflective of what emissions controls are currently installed and operational from TVA plants?

A. That's correct.

Q. With some growth, as you described earlier.

A. With some growth, yes.

And then, for mercury, you can see that you go from

about 3,000 pounds per year, you cut it roughly in half, the mercury I should say, through -- and that's just what I call a co-benefit of the fact that TVA would be reducing its NOx and SO2 emissions, that that comes at no additional cost.

Q. And did you, Dr. Staudt, compare TVA's current emissions with the reasonable emission levels that you've developed for their coal-fired system?

A. Yes, I did.

Q. So I want to refer your attention back to Plaintiff's Exhibit 52. Is this a table from your expert disclosure report?

A. Yes, it is.

Q. And this is a summary of the conclusions you reached about the comparison of TVA's current emissions with the reasonable emission rates that you developed for them?

A. That is correct.

Q. And did you use standard, reliable methods in putting together this figure? I'm sorry. Table.

A. Yes. Yes, I believe I did.

Q. And they accurately reflect your estimates of what TVA current emissions are as compared to reasonable emission rates?

A. It reflects the actual and also reflects what I call a 2013 base case, reflects some growth -- the equipment that is existing and operational.

Now, my understanding is, based upon Mr. Lancaster's comments, is that TVA has taken some measures to reduce sulfur in some of their coal, so perhaps their SO2 emissions are somewhat lower than this 2013 base case at this point, but still low above the 2013 CSA equivalent.

Q. And you also have a 2005 actual?

A. Yes. Yes. The 2005 actuals are actually recorded information from USEPA.

Q. And that's the most recent data that was available at the time you prepared your expert report?

A. Yes. When I prepared this report in 2006, that was the most recent information I had and the 2013 base case was my projection based upon the equipment that I expected to be in place.

Q. And as you testified earlier, your estimate of nitrogen oxide emissions for the 2013 base case assumed annual operation of post-combustion controls that are currently installed?

A. That is correct. So that 115,144 number, if you -- it should be -- it should be higher. And what it would be is similar to the actual but -- plus some accommodation for growth. So it would be somewhat higher, so somewhere in the order of 200,000 or a little bit more.

Q. So based on your analysis, how do TVA's current emission levels compare to the reasonable emission levels that you

developed?

A. Well, according -- if you look at this, there are at least three, close to four times what they -- what the reasonable emission levels are, and so that's why I would believe that they ought to be reduced.

Q. And those reasonable emission levels are based on your analysis of what you believe TVA can accomplish between now and 2013 as far as emissions reductions?

A. Yes. Yes, they are.

Q. And they're also based on what's being accomplished by Duke and Progress under Clean Smokestacks Act?

A. Yes, and what other utilities are doing. It's shown that, once motivated, these utilities can install scrubbers at a faster rate than what we're seeing right now at TVA.

MR. GOODSTEIN: Your Honor, at this time we offer Plaintiff's Exhibit 52 into evidence.

THE COURT: Let it be admitted.

(Plaintiff's Exhibit No. 52 received.)

BY MR. GOODSTEIN:

Q. Dr. Staudt, did you also prepare a graphical representation of the reduction in emissions that were to result from installation of additional controls as we identified in your testimony earlier?

A. Yes, I did.

Q. And I'm showing you Plaintiff's Exhibit 55 for

identification. Are these the graph -- graphical summaries that you prepared which show the data that we just looked at?

A. Yes. Yes. And again, I'd like to mention again that the base case estimate for NOx, in light of Clean Air Interstate Rule being vacated, in my opinion, it really would be reasonable to increase that to a much higher level because I don't see any reason why TVA would operate its SCRs on an annual basis absent that rule or some other requirement.

MR. GOODSTEIN: All right. At this time, Your Honor, it we offer Plaintiff's Exhibit 55 into evidence.

THE COURT: Let it be admitted.

(Plaintiff's Exhibit No. 55 received.)

BY MR. GOODSTEIN:

Q. Dr. Staudt, these controls that are being worked on by TVA currently, when they're installed, that will result in some reduction in their emissions?

A. Excuse me?

Q. Yeah. Once these scrubber projects that are under way, are installed, as we discussed earlier, that's going to result in some reductions in their emissions?

A. Well, I would expect so, assuming that they're operated. But, yes.

Q. Okay. Will that result in TVA being closer to these reasonable emission caps that you've developed?

A. Oh, certainly, the fact that TVA has made progress in

the last two and a half years since the case has been filed, makes it easier -- gets them that much closer to where they need to be to these caps, so it reduces the amount of additional effort necessary to reach these emissions caps.

Q. So they'll have less to do in the next four years?

A. That's correct.

Q. So they'll have less to do in the next four years, once these additional scrubbers become operational, in order to meet the reasonable emissions levels that you've developed?

A. That's correct. The incremental amount of work is reduced as a result of what they're doing right now.

Q. Is there a way to apportion the system-wide cap that you've developed; are there ways to apportion that among plants in the TVA system?

A. Yes. You could -- you could do that. What -- the way I would -- the way I would do that is to apportion it by projected generation. So that's one way to do it, if we were going to apportion it to different regions or different states.

Q. Okay. So can you tell us what portion of that cap would be apportioned to the plants on the eastern part of TVA's system, Widows Creek, Kingston, Bull Run and John Sevier?

MR. LANCASTER: Objection, Your Honor. This is outside the scope of his expert reports. Both of those expert reports which they've tendered to the Court, he's

provided lengthy analysis, and this opinion that he's about to express is not contained in the reports.

THE COURT: Let me understand what you're asking.

MR. GOODSTEIN: Your Honor, the emission levels, the reasonable emission levels that Dr. Staudt has developed for TVA system wide, can be apportioned among the plants using just a standard engineering analysis. It's part of Dr. Staudt's analysis that he's already done.

We've got the system-wide output-based emission levels on the board and they're already in evidence. So I'm just asking Dr. Staudt, if we were to look at apportioning those emission levels among the plants, either by state in the TVA system or by region, how -- roughly, how would that cap be apportioned geographically.

MR. LANCASTER: And our objection, sir, is that was not disclosed in any way, shape or form in the report, the standard engineering analysis Mr. Goodstein stated he would use. It does not describe this conclusion, and an opinion was not given. No basis for it was given. It's completely outside the scope of his expertise.

THE COURT: I'll sustain the objection. Move on to something else.

MR. GOODSTEIN: All right.

BY MR. GOODSTEIN:

Q. Dr. Staudt, in determining that TVA can achieve these

reasonable emission rates by 2013, did you look at a system -- I'm sorry -- unit-by-unit analysis of what controls could be applied to each unit?

A. Yes, I did.

Q. And I want to show you Plaintiff's Exhibit 98 for identification. Is this a summary table that was included in your report?

A. This is -- I'm not sure if this was actually in my report or if this -- this was provided to Sonoma Technologies.

Q. So is this a summary of the emissions that you provided to Sonoma Technologies for which you're basing your control case?

A. Well, what it shows, it shows -- this shows estimated 2013 NOx emissions from TVA coal-fired plants, and this -- this is a base case, with projections month by month because Sonoma Technologies needed month-by-month projections of NOx emissions in order to support their modeling.

Q. All right. So you did a number of summary tables on a unit-by-unit analysis for both your base case and your control case --

A. Yes.

Q. -- that was provided to other experts in the case?

A. That's correct.

Q. And let's go through them. So that was 98. Can we look

at Plaintiff's Exhibit 96 as well?

Is that another summary table of the unit-by-unit analysis that you did to scroll up to the summaries that are now admitted into evidence from your analysis?

A. Yes. Yes. These are the summaries for NOx and SO2 for base case, unit by unit.

Q. And Plaintiff's Exhibit 99 for identification are also unit-by-unit analysis that scroll up into the summaries that we looked at earlier?

A. Yes. These are -- these are -- this is the estimated SO2 emissions in the base case on a month-by-month basis.

Q. And Plaintiff's Exhibit 101, can you identify that?

A. These are the estimated 2013 SO2 emissions from TVA plants on month-by-month basis with -- assuming the additional controls. Kind of the control case. This is the control case.

MR. GOODSTEIN: Your Honor, at this time we offer 96, 99, 100, 101, 102, and 103 into evidence at this time.

I'm sorry. Not 103. 102 into evidence.

MR. LANCASTER: I believe you may have misstated. I believe he identified 98, 99, 101 and 96.

MR. GOODSTEIN: 96, 98, 99, 101 and 102.

MR. LANCASTER: I don't believe he's addressed 102.

BY MR. GOODSTEIN: Through 101 then, Your Honor. Sorry for the confusion.

THE COURT: 96, 98, 100, 101, and what have we left out?

MR. LANCASTER: I think we might better start this one over.

MR. GOODSTEIN: 96, 98, 99, 100 and -- I'm sorry. Give me one second, Your Honor. I was trying to do them all at once and save us time, but ...

Dr. Staudt, is Plaintiff's Exhibit 100 also a summary that scrolls up into the numbers that have already been admitted into evidence?

THE WITNESS: Yes. Exhibit 100 is also -- yes, Exhibit 100 is the month-by-month projected NOx emissions using additional controls.

MR. GOODSTEIN: All right. I'm going to try this again, Your Honor. I apologize for the confusion.

We offer 96, 98, 99, 100 and 101 into evidence.

MR. LANCASTER: And Your Honor, we don't object to 96 except to the extent that I already earlier objected to his qualifications to make the kind of generation projections he used in these. 96 was in his report. The remainder of them, 98, 99, 100, and 101 were not contained in his expert report and appear to be the same as 96, with monthly totals added.

MR. GOODSTEIN: Your Honor, if I might. These were the monthly totals that were provided to the modelers, air

quality modelers, who were retained by North Carolina. And as you recall, Your Honor, their report was due in advance of Dr. Staudt's report. It was due in August of 2006. Per the agreement of the parties, the air quality modeling report was exchanged several months in advance of when the rest of the plaintiff's expert reports were due.

So these tables were provided by Dr. Staudt to the air quality modelers who prepared their report, which was disclosed to TVA in August of 2006. So they had been disclosed to TVA in advance of when Dr. Staudt's report was disclosed in October of 2006. And this was per TVA's request to allow them to have six months with North Carolina's air quality modeling report.

So all these tables have been disclosed to TVA. They've had an opportunity to review the air quality modelers report, they've had an opportunity to review Dr. Staudt's report, they've taken several depositions of Dr. Staudt, so there's nothing in here that hasn't been disclosed to TVA in discovery.

MR. LANCASTER: I believe he's correct. These were attached to a different expert report. They were not, in fact, attached to Dr. Staudt's report. I have not investigated whether they are the same tables that were attached to Mr. Wheeler's report. I understand he's the next witness. I simply note they were not attached to Mr.

Staudt's expert report.

THE COURT: All right. I'll let these in.

MR. GOODSTEIN: Thank you, Your Honor.

(Plaintiffs' Exhibit Nos. 96, 98, 99, 100, and 101 received.)

BY MR. GOODSTEIN:

Q. Dr. Staudt, did you also have an opportunity to estimate the type of mercury that is being emitted from TVA's coal-fired power plants?

A. Yes, I did.

THE COURT: All right. I think we're going to break now for lunch. We'll start on this new evidence following lunch.

(Lunch recess.)

* * * * *

[END OF VOLUME 2A]

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NORTH CAROLINA
CERTIFICATE OF REPORTER

I certify that the foregoing transcript is a true and correct transcript from the record of proceedings in the above-entitled matter.

Dated this 15TH day of July, 2008.

S/ Karen H. Miller

Karen H. Miller, RMR-CRR
Official Court Reporter